Proceedings of

INTERNATIONAL SYMPOSIUM ON ANIMAL HEALTH AND DISEASE DATA BANKS

December 4-6, 1978
Washington, D.C.

United States Department of Agriculture

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Miscellaneous Publication Number 1381

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Sponsored By

- Animal and Plant Health Inspection Service
  Veterinary Services
- Science and Education Administration
  Technical Information Systems

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Section V. Animal Production and Economic Data

INTRODUCTION

The International Symposium on Animal Health and Disease Data Banks was held December 4-6, 1978, at Washington, D.C., jointly sponsored by Veterinary Services, Animal and Plant Health Inspection Service, United States Department of Agriculture, and Technical Information Systems, Science and Education Administration, United States Department of Agriculture, under the auspices of the Associates of the National Agricultural Library, Inc.

The idea of a symposium to advance international utilization of animal health and disease data banks was formulated during December 1977. A group of veterinary specialists of the Animal and Plant Health Inspection Service reviewed their requirements for both bibliographic and non-bibliographic data, noted the nature of some recent symposiums, and recognized the desirability of becoming better acquainted with operational data banks worldwide in five functional areas. These areas—literature, epidemiology, clinics, diagnostic laboratories, and research in progress—were then adopted as focal points of interest for bringing together managers, operators, and users of related data banks.

Animal health and disease data were perceived to include information on and related to impairment of the normal state of the living animal body by infectious, noninfectious, chemical, and physical factors that affect the performance of functions that are vital to life, affect normal life functions, affect the efficiency of production of food of animal origin, and affect the wholesomeness or stability of animal products.

Animal health and disease data banks merit the attention given them in an international symposium because of the urgent need to utilize the best available information in rational approaches to the production and conservation of food of animal origin. Recent reviews have shown that much of humanity depends upon lower animals not only for food, but also for motive power and personal income.[1] The vital role of scientific and technical information for food production and protection is widely recognized.[2]

Establishing personal and corporate contacts and increasing communication among data bank specialists were two of the more important immediate purposes of the symposium. Another purpose was to promote development of compatibility between data banks through such mechanisms and devices as standardized vocabulary, single language, standardized geopolitical terminology, and generally accepted species classification. Compatibility of data banks should facilitate more data pooling and analysis, and it should reduce the anticipated cost of online hookups.

Costs of information place unavoidable limitations on data bank development.[3] Data banks are expensive. A hoped for product of the symposium is the identification of significant and novel means to increase cost effectiveness, especially for the data bank user.

The concept of a *specialized information center* is reflected in the sectional structure of the symposium program. In such a conceptualized "center," the user can readily retrieve data from different information repositories in addition to his own collection. The nature of these repositories may range from a large file of technical data on a single commodity to a multidisciplinary bibliographic collection on agriculture, and could include the central facility of a computerized network dedicated to livestock disease epidemiology. Dr. Gary P. Combs has described an example of a specialized information center in his paper on the Emergency Programs Information Center (EPIC). Here a staff of trained subject matter specialists provides the interface between systems and many users who have neither the time, the detailed interest, nor the profile construction aids, such as numeric codes and thesauri, necessary to construct effective informational profiles.[4]

The symposium established and renewed acquaintanceships among a substantial number of scientific and technical specialists from a total of nine different nations, and it produced this volume of useful reports in the area of animal health and disease data banks. The texts of some papers have been slightly revised.

Special thanks are due the Section Chairpersons Wallace C. Olsen, David J. Matthews, Howard M. Hayes, Jr., Richard J. Crom, and David F. Hersey, who served also as members of the Program Planning Committee and as panelists; John Birdsall, who chaired the second day program; and Winthrop Ray, Calvin Campbell, and Waldo Keller, who served as a panel on epidemiological, laboratory, and clinical data banks.

Appreciation is also due Symposium Committee Chairpersons Leila Moran, Publications; Charles Skidmore, Publicity; and Gerald Sophar, Arrangements. Consultation to the Program Planning Committee by W. Max Decker, John Birdsall, and Nelson King is also acknowledged with special appreciation.

Edwin I. Pilchard,
General Chairperson

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THE MANAGEMENT OF DATA BANKS

On behalf of the Science and Education Administration, cosponsor of this symposium, I welcome you. I bring you greetings from Dr. Anson Bertrand, Director of SEA. We extend our best wishes for a very successful meeting.

I believe it is significant, apropos of my topic this morning, that when planning for this symposium took place some months ago, it was scheduled to be held on the fourteenth floor of the National Agricultural Library Building, which was then a conference center. During the intervening months we have seen that space taken over by a group of information systems. In fact, as I look around this building this morning I keep wondering if I might not fit the 4-H Publications Data Bank in some of this space.

This must undoubtedly be the first concern of the data bank manager—where to put the people and hardware. These systems have come upon us so suddenly and in such great numbers that we are hard pressed to accommodate them. I have spent most of my career as a manager of academic libraries. We used to joke about books taking over all of the buildings on campus. Little did we realize how well off we were. Books sit quietly on the shelves. These new data banks bring with them an entourage of prima donnas, both human and mechanical. The hardware comes dragging great umbilical cords that must be plugged in somewhere. It does not sit quietly and do its thing. It hums, pants, chatters, and has frequent temper tantrums called "down time." It doesn't like carpets. The floor beneath it must be finished with a special wax, and it sneers at the quality of the air conditioning we have been providing for rare books. Nevertheless, we have learned to live with it. It has hooked us on the way it does things and the products it gives us. We cannot imagine an information world without it.

The second concern of management is the development of human beings who can manage data banks. Quality program managers do not come down the pike very often; we have too few of them. I need not tell you that there are perhaps too many amateurs in this business. I can say that because I am one of them. The sooner we develop a corps of professional data bank managers the better off we will be. The sooner we develop a code of professional ethics, the more confident we will be of sustaining systems when their developers move on to greater challenges. Each of us needs to attract and groom the best minds to carry on this important work we do.

Our professional managers must have the skill, talent, insight, and energy to assess user needs. I am reminded of a conversation I had some years ago with a group of students. It took place in the central foyer of a very reputable academic library near the great two million card catalog

and within sight of the great bookstack. I was describing the library with some pride when one of the students spoke up and said, "Sir, I don't mean to be rude, but I think this is a lousy library. I can never find anything I need." It was thus a few days ago, when an examiner from the Office of Management and Budget said to me, "I'm beginning to wonder about that data bank. Twice during the past few weeks it has been unable to provide me with data I need." Here was the person with great control over my funds telling me that I had failed to meet her needs! I would only have boxed myself into a tighter corner if I had told her the truth—that the data bank was not designed with her needs in mind. Policy makers are going to bring their big guns to bear on us if we do not get out of this rut. Last week a report came to my desk entitled "Changing Character and Structure of American Agriculture." This is a study by the staff of the General Accounting Office. The final chapter is entitled "Serious Gaps in Data Have Made the Picture of the Changing Structure of Agriculture Incomplete." This chapter goes on to say, "Many data gaps hamper the ability of policy makers to carry out an effective, timely, and rational decision making process which can influence the trends in American agriculture. Farm structural information could be combined with all types of farm production statistical information into a systematic data collection review and feedback system. Improved information on the changing structure and character of American agriculture is needed, if policy makers are to be in a position to take actions which will be effective for the total agricultural system."

Think about that during these next three days as you hear about and discuss the many fine data banks listed in your program. Have we developed data banks for tight little groups of exclusive users? Could and should we spend more time coordinating our data gathering activities—making it possible for more people to have easy access to them? I get the impression that we sit huddled over our little buckets of information continually sorting and dispensing them on our own terms. Are we developing a kind of priesthood of narrow interests in which our time is being spent in protecting our own *best way* of collecting and dispensing information?

At the end of this symposium, will you be confident that the animal health and disease data banks are giving this country and the world the big information picture that it so urgently needs? Let us hope that your written proceedings will be more than an historical record. We cannot rest on our laurels. These are perilous times for data banks that appear to be esoteric. As Oscar Wilde pointed out, "A cynic is a man who knows the price of everything, and the value of nothing." More and more cynics are turning their attention to us.

Among the ancient Greeks a symposium was a convivial meeting, usually following a dinner, for drinking, conversation, and intellectual entertainment. I toast you at the beginning of this one and I hope your output will chart the future direction for information managers.

Richard A. Farley,
Deputy Director for Technical Information Systems, Science and Education Administration, U.S. Department of Agriculture

ACRONYMS AND ABBREVIATIONS

AAAP	American Association of Avian Pathologists
ABAH	Australian Bureau of Animal Health
AGLINET	International Agricultural Libraries Network
AGREP	Agricultural Research Projects in the European Communities
AGRINDEX	Publication of AGRIS
AGRICOLA	Agricultural Online Access
AGRINTER	Latin American equivalent of AGRIS
AGRIS	Agricultural Information Service (FAO)
AIBA	Agricultural Information Bank for Asia
ANADIS	Australian National Animal Disease Information System
ANSI	American National Standards Institute
AOAD	Arab Organization for Agricultural Development
APHIS	Animal and Plant Health Inspection Service
ARS	Agricultural Research Service (USDA)
ASF	African swine fever
BA	Biological Abstracts
BioI	Bioresearch Index
BINAGRI	Biblioteca Nacional de Agricultura (Brazil)
BIOSIS	Biosciences Information Service
BRACARIS	Brazilian Current Agricultural Research Information System
CAB	Commonwealth Agricultural Bureaux
CAIN	Cataloging and Indexing
CANSIM	Canadian Socio-Economic Information Management System
CARIS	Current Agricultural Research Information System (FAO)
CAS	Chemical Abstract Service
CBAH	Commonwealth Bureau of Animal Health
CELEX	Inner Institutional System of Automated Documentation for Community Law (EEC)
CEMA	Council for Mutual Economic Assistance (Centrally Planned Countries)
CGIAR	Consultative Group on International Agricultural Research
CILES	Central Library, Information and Editorial Section of CSIRO
CNDA	Centre National de Documentation Agricole (Tunisia)
CNR	Consiglio Nazionale della Ricerche (Italy)
COBOL	Common Business Oriented Language
CRIS	Current Research Information System (USDA)
CRONOS	Data bank of EEC Statistical Office
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DIALOG	Name given to computerized data bases available for searching through the Lockheed Information System

ECDOC	European Economic Community's Documentation for the Commission
EDP	Electronic Data Processing
EEC	European Economic Community
EPIC	Emergency Programs Information Center
ERS	Economic Research Service (USDA)
ESCS	Economics, Statistics and Cooperatives Service (USDA)
ESIC	Environmental Science and Information Center
EURONET	European Online Information Network
EUROSTAT	European Statistics (EEC)
FAO	Food and Agriculture Organization
FAS	Foreign Agriculture Service (USDA)
FEOGA	European Agricultural Development Fund (EEC)
FMD	Foot and mouth disease
HC	Hog cholera
HEEP	Abstracts on Health Effects of Environmental Pollutants
IBAH	Inter-African Bureau of Animal Health (superseded by IBAR)
IBAR	Inter-African Bureau for Animal Resources
IDC	Infectious Diseases Committee of MVMA
IICA	Interamerican Institute for Agricultural Sciences
ILCA	International Livestock Center for Africa
ILO	International Labor Organization
ISIS	Integrated Set of Information Systems
KWIC	Keyword in Context
KWOC	Keyword out of Context
LADB	Laboratory Animal Data Bank
MAFF	Ministry of Agriculture, Forestry and Fisheries (Japan)
MBIRS	Marine Biological Information Retrieval System
MEDLARS	Medical Literature Analysis and Retrieval System
MEDLINE	MEDLARS online
MLC	Meat and Livestock Commission (United Kingdom)
MLSB	Minnesota Livestock Sanitary Board
MMB	Milk Marketing Board (United Kingdom)
MVMA	Minnesota Veterinary Medical Association
NAIS	National Aquaculture Information System
NCI	National Cancer Institute
NCPDC	Northcentral Poultry Disease Conference
NECAD	Northeastern Conference on Avian Diseases
NRP	Notice of Research Project (input and output form of SSIE)
OASIS	Oceanic and Atmospheric Scientific Information System
OECD	Organization for Economic Cooperation and Development
OIE	International Office of Epizootics
PASCAL	Programme appliqué a la selection et la compilation automatique de la literature

SCAD	Southern Conference on Avian Diseases
SCDDS	Southeastern Cooperative Deer Disease Study
SCISEARCH	Online version of Science Citation Index, produced by Institute for Scientific Information
SCWDS	Southeastern Cooperative Wildlife Disease Study
SDI	Selective Dissemination of Information
SEA	Science and Education Administration (USDA)
SEARCA	Southeast Asian Regional Centre for Graduate Study and Research in Agriculture
SEP	Swine enzootic pneumonia
SNIDA	Sistema Nacional de Informaçao e Documentaçao Agricola (Brazil)
SNVDO	Standard Nomenclature of Veterinary Diseases and Operations
SPF	Specified pathogen free
SSIE	Smithsonian Science Information Exchange
UDC	Universal Decimal Classification
UN	United Nations
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNISIST	Program of UNESCO
USDA	United States Department of Agriculture
VETDOC	Veterinary Literature Documentation
VE	Vesicular exanthema
VEE	Venezuelan equine encephalomyelitis
VETEC	Veterinary Literature Documentation for the Economic Community
VETTERM	Veterinary Terminology
VIC	Veterinary Investigation Centre
VIDA	Veterinary Investigation Diagnosis Analysis
VMDP	Veterinary Medical Data Program
VSAM	Virtual Storage Access Method
WARDA	West African Rice Development Association
WHO	World Health Organization

SECTION I

BIBLIOGRAPHIC SYSTEMS

Wallace C. Olsen, Chairperson

INTRODUCTION

Bibliographic files in computerized form and available for batch or online searching constitute perhaps the greatest intellectual resource of any of the sections in this symposium. The citations available online today dealing with animal health and disease number nearly a million, depending upon definition and including overlap between files. To attempt to cover this incredible spread in detail seemed an immense task as well as one that probably was not necessary. General information as well as more detailed examinations of the major appropriate files* are widely available. Therefore, speakers were asked to concentrate on detailed aspects of the files as they related to animal health and disease, and to give the audience an update of new activities or changes of policy which might be relevant. Several large files (e.g. AGRICOLA, MEDLINE) were not represented in the papers at all. The reader of this section must keep this in mind since the intention was to explore new files or areas of expansion. The only major exception to this policy is Mr. D. E. Gray's paper, which is a summary of the most recent, relevant landmark work and its implications.

Wallace C. Olsen,
Chairperson

*H. Brodauf, W. D. Hoffman, and J. H. T. Klawiter-Pomer, *Searching the Veterinary Literature Retrospectively: A Comparative Study of the Results from Ten Data Bases Covering the Period January 1972 to December 1974* (Luxembourg: Commission of the European Communities, 1978).

A second major European work which should not be missed is *Factual Data Banks in Agriculture; Proceedings of the Symposium Organized by the Commission of the European Communities, Held in Luxembourg, July 12-13, 1977* (Wageningen, Netherlands: Centre for Agricultural Publishing and Documentation, 1978, 115 pages), containing presentations on nineteen diverse systems with some discussion.

A EUROPEAN STUDY OF VETERINARY COMPUTER-BASED BIBLIOGRAPHICAL INFORMATION SYSTEMS

David E. Gray*

The Commission of the European Communities placed a contract with the Hanover Veterinary School in 1974 to study the value, for retrospective searches, of the large computer-based information systems. At that time it was clear that machine information services were on the point of becoming generally available in Europe; in addition a European information network, EURONET, was in an advanced stage of planning. It was decided to attempt to define the information needs of veterinarians, and to attempt to estimate the ability of the large information systems to satisfy these needs, in order that the appropriate services could be included in EURONET.

A practical investigation was instituted, based on a detailed study of ninety genuine requests for information, selected from 686 queries offered by veterinarians from all the nine member countries of the European Economic Community. The ninety queries chosen were those which, among them, covered all the subject areas of veterinary science. A search for information on all of the queries was made on the following information systems:

CAB—Commonwealth Agricultural Bureaux, which includes the two specialist veterinary information services, *Index Veterinarius* and *Veterinary Bulletin*
AGRICOLA—The machine readable form of *Bibliography of Agriculture* (during the study, this was known as CAIN)
MEDLINE—Derived from *Index Medicus*, at that period known as MEDLARS and searched in batch mode
BIOSIS—From *Biological Abstracts* and *BioResearch Index*
PASCAL—The machine form of the French abstract service, *Bulletin signalétique*

In addition, whenever the subject matter of the query indicated that they would be useful, the following services were used: *Excerpta Medica*, *Food Science and Technology Abstracts*, *Chemical Abstracts Condensates*, VETDOC, and *Chirurgia Veterinaria*. The information services provided literature references for three years, 1972 to 1974, and the lists of references produced were sent to inquirers, who were asked to indicate which were relevant. Relevancy assessments were received on the references for eighty of the ninety queries, comprising a total of 44,715 references. A computer

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program was developed at Hanover which allowed the performance of the information services to be assessed by a number of criteria. The most useful criteria turned out to be the following:

(a) unique relevant references produced by an information system;
(b) precision (the number of relevant references divided by all the references produced by an information system);
(c) recall (the number of relevant references produced by one information system divided by the number of relevant references produced by all the information systems used.

A full report[1] of the study has been published by the Commission of the European Communities, and a brief account is also available.[2]

RESULTS

The general results of the study are shown in Figure 1. This constitutes an assessment of the relevance of the references found for the eighty queries by the five major information systems. The most important result is that all five systems are of similar value; equally important, all produced references found by none of the other systems. Veterinary science clearly calls on the fundamental science of biology and the associated disciplines of human medicine and general agriculture for much of its information. The rather large proportion of non-relevant references found is not typical of current conditions. The searches were mostly conducted in batch mode, and by general service organizations remote from the inquirers. These days many searches are conducted online and by a librarian or information officer in direct contact with an inquirer. Online working allows for much refinement of the search strategy, and discussion with the inquirer enables the query to be much more precisely formulated. These general results have been borne out in practice. The use of machine information services in the Library of the Central Veterinary Laboratory in finding information on 155 of the subject inquiries received in the first nine months of 1978 is presented in Table 1. PASCAL is not included in this table, as it is not one of the systems used by the Central Veterinary Laboratory Library.

These overall results do not, of course, indicate that for a particular inquiry all the five systems should be used. This is shown by an analysis of the relevant references found on *Tetracyclines in eggs of layer-hens.* Nine information systems were used and thirty relevant references produced. Twenty-six of these references were supplied by AGRICOLA and *Chemical Abstracts Condensates* in combination; BIOSIS, CAB, *Excerpta Medica,* and VETDOC each supplied one further reference. This demonstrates that, in practice, only two information systems would be used for a query of this nature, and this is supported by experience at the Central Veterinary Laboratory, where an average of 1.72 systems are searched for each inquiry.

FIGURE 1. Overall Performance of the Five Main Veterinary Computer-Based Information Systems

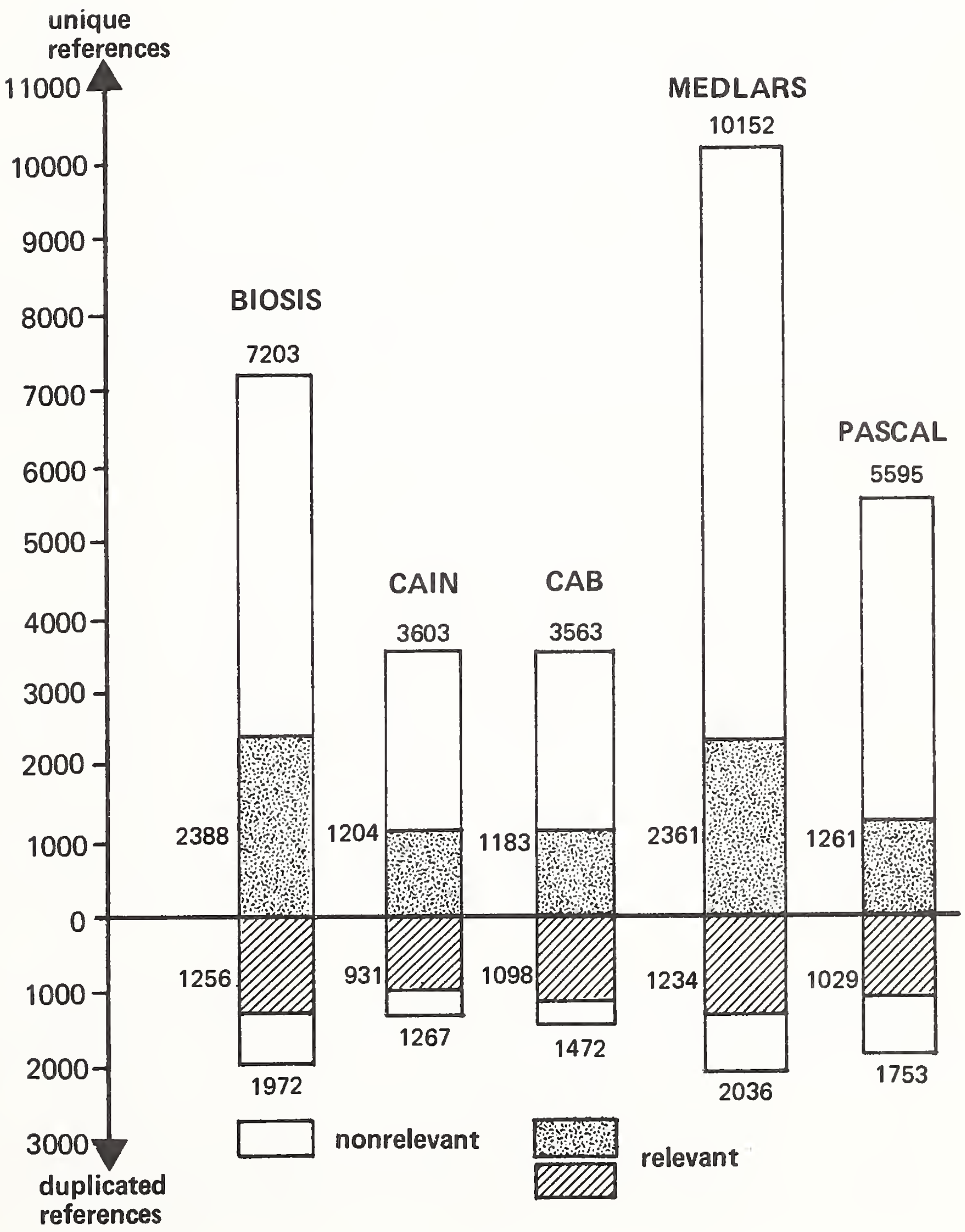

TABLE 1. Use of Machine Information Services in 1978 at the Central Veterinary Laboratory

Commonwealth Agricultural Bureaux		26.0%
BIOSIS		25.3%
MEDLINE		21.7%
AGRICOLA		20.9%
Chemical Abstracts Condensates		2.9%
Excerpta Medica		1.4%
SCISEARCH		1.1%
Food Science and Technology Abstracts		0.7%
	Total	100.0%

In the study, an effort was made to calculate the comparative effectiveness of the five major information systems. Points were allocated to each system according to its performance in relation to each of the twenty-one subject areas into which the eighty queries were divided. The result is shown in Table 2.

TABLE 2. Comparative Evaluation of the Five Major Information Systems

	CAB	AGRICOLA	BIOSIS	MEDLINE	PASCAL
Unique relevant references	256	262	266	262	184
Recall	251	252	258	264	187
Precision	310	249	237	214	216
Total	817	763	761	740	587

Apart from PASCAL, which is a system covering all science and could not be expected to function particularly well in a rather specialized area, the effectiveness of the other four systems is much the same, as far as the production of unique relevant references and recall are concerned. The slight superiority of CAB is explained by the specialized indexing of veterinary topics in *Index Veterinarius* and *Veterinary Bulletin* which automatically affords greater precision in retrieving appropriate references. These conclusions are borne out by experience in the use of these four

information systems, which are equally efficient when used for suitable aspects of veterinary science. Suitability of a particular information system is influenced not only by the nature of the inquiry, but also by the professional status of the inquirer. There was an indication in the study that practicing veterinary surgeons were better served by CAB, and research scientists and teachers by BIOSIS.

Inquirers were invited to indicate any non-relevant references which were of interest even though they had no direct bearing on the query. In all the systems, an average of forty-three percent of all non-relevant references were considered to be of this nature. This surprisingly high proportion suggests that, in practice, great precision, with its automatic reduction in recall, need not be sought. It might be better rather to offer an inquirer more relevant and non-relevant references, hoping that some of the latter might be of fringe interest.

Figure 1 shows that CAB produced only twenty percent of the total relevant references. It was assumed in the thirties that an abstracting service set up for a profession was the sole source of all the information required. The study indicated that this is not true now in regard to veterinary science. A veterinarian requires much information from related disciplines, in addition to that from his own discipline. Figure 1 also shows that all the systems provided unique references, there was duplicate recording of references (this is true of at least twenty percent of the references), and no system was able to provide all the references on its own. All systems provided irrelevant references.

CONCLUSIONS

The study showed that each system recorded material included in one or more of the other systems. This duplicate recording was not great; it amounted only to twenty percent of references. It can be assumed that some of these items were abstracted and indexed from different aspects in each system, which would justify the duplication. Further, some items have clear importance to more than one discipline, and must therefore be recorded by more than one information system. The authors of the study did, however, consider that the amount of duplication was too high, and suggested that this could be reduced by cooperative rationalization of the lists of periodicals searched.

There was no indication in the reactions of inquirers that any information had been missed. All the information required by veterinarians is already recorded in one or another of the systems, and no new information system for veterinary science is required in addition to *Index Veterinarius* and *Veterinary Bulletin*. Even though relevant material is spread through several systems, the facility offered by services like Lockheed (and in the near future by EURONET) to search several data bases successively overcomes any practical problem which might result from this.

ANIMAL HEALTH INFORMATION IN THE BIOSIS DATA BASE

Robert Marchisotto*

Veterinary scientists have available to them a number of information systems which serve the whole field, some portion of it, or a specific specialty. Some of the more familiar services, PASCAL (France), MEDLARS (USA), CAIN (USA), CAB (Britain), and BIOSIS (USA), were studied by Brodauf et al.[1] It is beyond the scope of this paper to review these services extensively or in any great depth; several excellent reviews have been published and more detail can be obtained from these sources.[2] Suffice it to say, there are some 2,500 abstracting and indexing services worldwide[3] and, of these, essentially sixteen can be considered to contain enough significant animal health data to be of interest as information sources to veterinary scientists. This paper will study one such organization, BIOSIS: how it functions, the scope of its coverage, the animal health data it generates, and how veterinary scientists may avail themselves of this information resource to assist them in their work.

THE BIOSIS ORGANIZATION, PRODUCTS, AND SERVICES

BIOSIS, an independent not-for-profit organization, is the world's largest English-language abstracting and indexing service for the life sciences. Founded over fifty years ago, BIOSIS has had a long and productive association with many scientific societies such as the American Association for the Advancement of Science, National Academy of Sciences, American Institute of Biological Sciences, and the Federation of American Societies for Experimental Biology.[4] With the initial publication of *Biological Abstracts* in 1926, BIOSIS has provided biological research information to individuals, educational and research institutions, government agencies, and industrial corporations. Approximately one hundred staff biologists, advised by leading subject specialists throughout the world, collect, translate, abstract, and index the life-sciences literature published in over 8,000 sources comprising serials, books, monographs, conference proceedings, notes, and research communications.

The mission of BIOSIS—to serve the information needs of the life-science community—requires an enormous bibliographic undertaking. In 1978, 262,000 new items were added to the data base, with 275,000 planned for

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1979; over one hundred countries[5] contribute to the literature base from which these items are selected. Since BIOSIS' inception, four million bibliographic references have been accumulated in the data base with two million of these instantly accessible on major online computer systems.

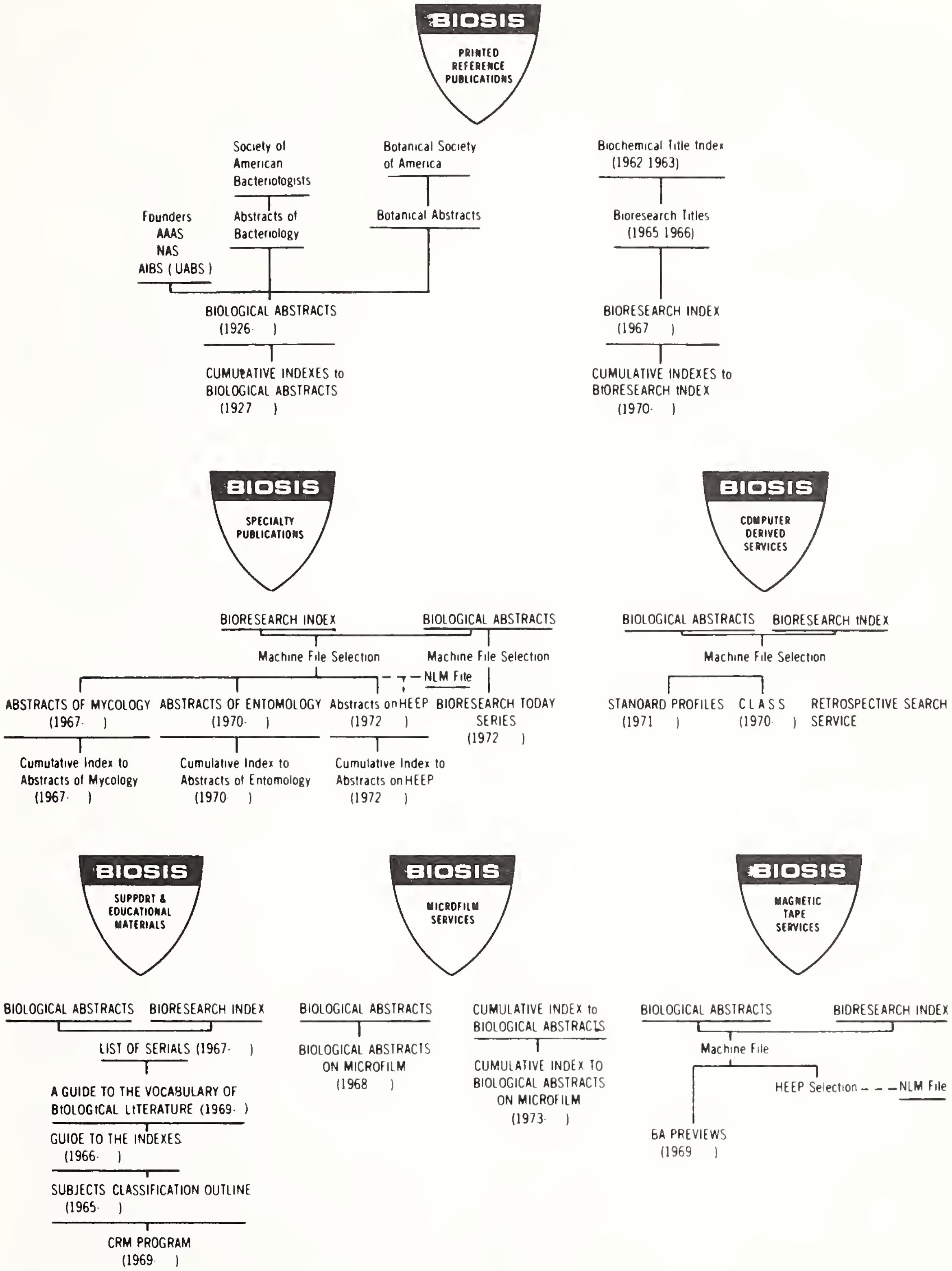
In addition to its major printed publications, *Biological Abstracts* (BA) and *BioResearch Index* (BioI), BIOSIS publishes three derivative publications, *Abstracts of Mycology, Abstracts of Entomology,* and *Abstracts on Health Effects of Environmental Pollutants* (HEEP), and a special publication, *BioResearch Today,* with monthly current awareness abstracts on fourteen selected topics, three of which—Human and Animal Aging, Human and Animal Parasitology, and Pesticides—are pertinent to the animal health field. Also available are a machine-readable version of the data base, *BIOSIS Previews,* and a computer-derived current awareness service, *BIOSIS Standard Profiles*, and, most recently, a machine-readable form of the abstracts in BA, *Biological Abstracts on Tape.* The standard publications are also available in microform versions—microfilm and microfiche. A summary of the various BIOSIS services available, their origin and development, are portrayed in Figure 1.

PREPARATION OF THE BIOSIS DATA BASE

One must first appreciate that the selection of research publications for inclusion in BIOSIS is on an article-by-article basis. Consequently, a review of journal titles from the more than 8,000 serials screened[6] does not allow an objective analysis of the coverage in a particular field. While there are undoubtedly many journals whose scope would be considered to be primarily "animal health," there are many more whose titles would not seem pertinent, but whose content would be relevant to the subject matter of "animal health." BIOSIS analyzes each article for storage and retrieval from three viewpoints and, as will be seen, one can access BIOSIS' "animal health" coverage from a content-oriented standpoint.

The first method of approach employs the specific scientific words embodied in the title, abstract, and full text of the article. During the staff editor's analysis, these words are identified, their spelling is standardized to American forms, and the consistency of terminology and usage is assured through various verification steps. These entries provide approximately fifty percent of the specific retrieval characteristics of the file. On the average, seven of these words are found in the title, while an additional twelve are selected from the abstract or the full text, resulting in nineteen "natural" language entries for each paper. Although these words are used in veterinary scientific communications, they are not sufficiently delimiting in and of themselves to determine their import to the animal health field.

The other two methods, classification and taxonomic "identity," are more directly related to the subject matter of interest to the animal health field. Each article selected is classified according to a schedule of more



*Dates shown indicate year service was first offered.

Fig. 1 - BIOSIS FAMILIES OF SERVICES: ORIGIN AND DEVELOPMENT

than 600 concept categories in the life sciences. As opposed to the natural language employed in the first method, this approach relates highly specific works to broader concepts in life science. Articles, of course, are rarely related to a single concept or scientific discipline; rather, they cover a range of ideas and are often interdisciplinary. In addition to the application of these "concept headings," a level of importance within the context of the article is associated with each: primary, secondary, and tertiary.

The primary level is the concept category judged to be appropriate for the abstract to appear in the subject area organized in the printed BA. However, for machine retrieval purposes the secondary level classifications, which represent additional areas of major emphasis in each paper, are of equal importance; the tertiary level is for concept categories of lesser importance, but of sufficient impact to warrant additional classification.

The third method employed—taxonomic identification—provides another means of characterization and retrieval. Genus-species names and common names of animals are handled as natural-language elements described earlier in the first method. In addition, each such name is related automatically to its higher taxonomic grouping of phylum, class, order, or family. This provides access to articles dealing with these groups even if the authors did not originally make reference to the hierarchy in their papers.

CHARACTERIZATION OF ANIMAL HEALTH INFORMATION IN THE BIOSIS DATA BASE

Admittedly it is difficult to formulate a definition of what constitutes animal health information. However, if we define it as those areas dealing with animal health, animal production, and veterinary medicine, as the prospectus for this symposium indicates, then we can select specific categories in the BIOSIS data base to explore. These categories (named after the sections and sub-sections appearing in BA) are the following: Animal Production—General and Methods, Feeds and Feeding, Breeds and Breeding; Poultry Production—General and Methods, Feeds and Feeding, Breeds and Breeding; Laboratory Animals—General, Gnotobiology; Veterinary Science—General and Methods, Pathology, Microbiology; Parasitology—Veterinary; Toxicology—Veterinary; Ecology—Wildlife Management Aquatic, Wildlife Management Terrestrial. The data in Table 1 are listed according to each of the three categories and illustrate the number of times articles were referenced to the three levels of classification for each category during the five-year period, 1974-1978. For example, for that period, 29,538 articles were assigned to the Animal Production section, of which 8,874 dealt with breeds and the breeding of animals; 4,060 dealt primarily with the subject; 2,800 dealt primarily with some other biological discipline but emphasized in a major way breeds and breeding of animals; and there were 2,014 cases where the subject was not of major import in the paper but dealt sufficiently with some aspect of it to warrant attention.

TABLE 1. Animal Health Information in BIOSIS Data Base 1974-1978

SECTION/SUB-SECTION	ARTICLES ASSIGNED Primary(P)	Secondary(S)	Tertiary(T)	P+S+T
Animal Production				29,538
General, Methods	1,508	2,277	2,746	
Feeds, Feeding	8,182	3,958	1,993	
Breeds, Breeding	4,060	2,800	2,014	
	13,750	9,035	6,753	
Ecology				17,432
Wildlife Management				
Aquatic	6,504	3,614	1,374	
Terrestrial	2,712	2,097	1,131	
	9,216	5,711	2,505	
Laboratory Animals				5,782
General	363	1,282	2,986	
Gnotobiology	96	571	484	
	459	1,853	3,470	
Parasitology				5,516
Veterinary	2,088	2,764	664	
Poultry Production				8,091
General, Methods	608	931	978	
Feeds, Feeding	2,134	1,196	464	
Breeds, Breeding	592	649	539	
	3,334	2,776	1,981	
Toxicology				3,036
Veterinary	1,395	1,033	608	
Veterinary Science				35,367
General, Methods	325	2,623	4,731	
Pathology	533	12,161	4,652	
Microbiology	0	7,925	2,417	
	858	22,709	11,800	
TOTALS	31,100	45,881	27,781	104,762

Table 2 is of interest for two reasons. First, the data indicate that the animal health field, as it is defined by the section headings chosen, comprises 7.3 percent or 8.5 percent of the total BIOSIS data base, depending upon whether one deals with actual articles or assigned articles, respectively; the latter case could be described as an "effective" percentage as contrasted to a nominal percentage. In either event, these percentages do not reflect the true potential for accessing a given specialty field's literature, as will be evident from the example developed in the next section of the paper, but rather represent the *minimum* one might expect to find in a given specialty area. Secondly, the number of assigned articles exceeds the number of actual articles, indicating assignment of an article to more than one section or sub-section. In reality, our internal studies show that a given article has, on the average, one primary assignment, four secondary assignments, and five tertiary assignments. All of this in-depth indexing accounts in part for the uniqueness of the BIOSIS system and the multiplicity of access routes to the references stored within it. In effect, it expands considerably the coverage of a discipline beyond the boundaries established by the formal sections listed in Tables 1 and 2.

TABLE 2. Animal Health Articles Compared with Total Articles* in BIOSIS Data Base: 1974-1978

Section Headings	Actual Articles	% Data Base	Assigned Articles**	% Data Base
Animal Production	25,959	2.11	29,538	2.40
Ecology	17,214	1.40	17,432	1.41
Laboratory Animals	5,673	0.46	5,782	0.47
Parasitology	5,516	0.45	5,516	0.45
Poultry Production	6,896	0.56	8,091	0.66
Toxicology	3,036	0.25	3,036	0.25
Veterinary Science	25,805	2.09	35,367	2.87
TOTALS	90,099	7.32	104,962	8.51

*1,232,000 articles
**P+S+T (Table 1)

SEARCH AND RETRIEVAL OF ANIMAL HEALTH INFORMATION IN THE BIOSIS DATA BASE

However the incoming animal health literature is handled and put into the data base, access to it is accomplished by a unique and definitive set of indexes for the printed publications and a comprehensive searching strategy for the machine-readable magnetic tape version. Each printed reference

publication issue (BA, BioI, HEEP, *Abstracts of Entomology, Abstracts of Mycology)* includes five computer-generated indexes; cumulative indexes are also prepared for each volume of these publications. The indexing system has been carefully developed to afford optimum retrieval of pertinent references within all areas of biological research. The five indexes, which are the result of BIOSIS' pioneering efforts in the development of computer-assisted indexing in biology, provide the researcher with access to the literature from multiple points of entry according to the nature of his research. They are as follows:

- o Author Index. An alphabetic listing of personal and corporate author names followed by their reference numbers.

- o Subject Index. Based on specific subject terms (e.g. schistosomiasis). It is derived from the author's title enriched by the addition of significant key terms selected from the abstract and/or full text. The computer permutes (creates an entry for every significant key term or title word) the material and creates an alphabetic index.

- o Concept Index. Based on broad subject headings (e.g. Chemotherapy—Antiparasitic, Parasitology—Veterinary). Where research papers involve several subject concepts (e.g. genetics, cancer, and virology) they are indexed under as many subject headings as necessary to indicate relationships among them. More than 600 major subject headings are used in the Concept Index.

- o Biosystematic Index. Allows retrieval of references according to gross taxonomic categories, i.e. phylum, class, order, and family. Each entry includes a subject heading which indicates a major emphasis of that article. New taxa are specifically identified.

- o Generic Index. For more precise identification of organisms, lists genus-species names in alphabetic order. Each entry includes a subject heading which indicates a major emphasis of that article. New taxa are specifically identified.

Each issue of the publications provides detailed instructions on how to use the indexes to search the literature most effectively.

To illustrate with an example: A veterinarian may be interested in searching the literature for references to heartworm infestation in the dog and its treatment. The subject can be searched in the Subject Index under the natural language terms *dog, heartworm,* and *diethyl carbamazine* or any other chemotherapeutic agent used; in the Generic Index under *Canis familiaris* for the dog or *Dirofilaria immitis* for heartworm; in the Biosystematic index under the family, *Canidae* (if one desires to broaden the search to encompass other members of the dog family); or in the Concept Index under any of the section (concept) headings described in Table 1 or, additionally, *Chemotherapy-Antiparasitic Agents.*

Of course, the whole search and retrieval process is enhanced by present online computer techniques and a similar approach can be used on *BIOSIS*

Previews, the magnetic tape version of the BIOSIS data base. Another BIOSIS publication, *BIOSIS Previews Search Guide*, describes various search strategies for accessing the file. Table 3 lists the world-wide network of information centers offering *BIOSIS Previews* services.

TABLE 3. Information Centers Offering Service from *BIOSIS Previews*

Argonne National Laboratory Argonne, Illinois	National Institutes of Health Bethesda, Maryland
Bibliographic Retrieval Services Binghamton, New York*	National Library of Australia Canberra, Australia
Bulgarian Academy of Science ZINTI Sofia, Bulgaria	Sankyo Pharmaceutical Co. Tokyo, Japan
Canada Inst. Scientific & Technical Information Ottawa, Ontario, Canada*	System Development Corp. Santa Monica, California*
Council for Scientific & Industrial Research Pretoria, South Africa	Tsukuba University Tsukuba, Japan
Deutsches Institut f. Medizinische Dokumentation u. Information Cologne, West Germany*	Union Carbide Nuclear Division Oak Ridge, Tennessee
EMBRAPA Brasilia, Brazil	United Kingdom Chemical Information Service/Institute of Biology Nottingham, United Kingdom
ESRIN-SDS Frascati, Italy*	U.S. Department of Agriculture Beltsville, Maryland
Karolinska Institutet Medical Information Center Stockholm, Sweden	University of Connecticut NERAC Storrs, Connecticut
Lockheed Information Systems Co. Palo Alto, California*	University of Georgia Athens, Georgia
	University of Hawaii Honolulu, Hawaii

*Online Facility

The data base was searched for the years 1974-1978 and the number of references retrieved ("hits") for each individual search term is listed in Table 4. Further refinement, by combining search terms, led to the counts in Table 5 and the retrieved references listed in Table 6.

TABLE 4. Computer Search: Heartworm Infections in Dogs and Treatment, 1974-1978. Single Term Counts

Search Term	Significance	References Retrieved
Canidae	Family	32,570
Canis	Canine Genus	876
Canis familiaris	Dog Genus-Species	159
Dog(s)	Common name	28,581
Beagle(s)	Variety	609
German Shepherds(s)	Variety	21
Dirofilaria	Microfilaria Genus	225
Dirofilaria immitis	Heartworm Genus-Species	186
Dipetalonema reconditum	Heartworm Genus-Species	19
Heartworm	Common name	34
Dirofilariasis	Disease entity	28
Chemotherapy-antiparasitic	Drug treatment	6,381
Dithiazanine	Chemotherapeutic agent	18
Abminthic	Trade name	0
Dilombrin	Trade name	2
Dejo	Trade name	0
Deselmine	Trade name	0
Ditur	Trade name	0
Dizan	Trade name	0
Netocyd	Trade name	0
Partel	Trade name	0
Smiray	Trade name	0
Telmid	Trade name	0
Phenthion	Chemotherapeutic agent	1
Bayer 9007	Trade name	0
Entex	Trade name	0
Mercaptophos	Trade name	22
Queletox	Trade name	0
Bay 29493	Trade name	0
Tiguvon	Trade name	6
Lebaycid	Trade name	2
Ent 25540	Trade name	0
Baytex	Trade name	29
Talodex	Trade name	0

TABLE 4. Computer Search: Heartworm Infections in Dogs and Treatment, 1974-1978. Single Term Counts (cont'd.)

Search term	Significance	References Retrieved
Thiacetarsamide	Chemotherapeutic agent	5
Caparsolate	Trade name	1
Caparside	Trade name	0
Arsenamide	Trade name	1
Stibophen	Chemotherapeutic agent	27
Lyo-Antimon	Trade name	0
Fuadin	Trade name	0
LAT	Trade name	0
Diethylcarbamazine	Chemotherapeutic agent	194
Banminth D	Trade name	2
Dec Sol	Trade name	0
Dirocide	Trade name	0
Eosinopin	Trade name	0
Francocide	Trade name	0
Hetrazan	Trade name	19
Longicid	Trade name	0
Loxuran	Trade name	0
Nadacide	Trade name	0
Supatonin	Trade name	0
Dictiocid	Trade name	0
Filaribits	Trade name	0

TABLE 5. Computer Search: Heartworm Infections in Dogs and Treatment, 1974-1978. Multiple Term Counts

Search Terms (See Table 4, as grouped)	References Retrieved
Drug names + dog terms	13
Parasite or disease entity terms + dog terms	135
Drug names + parasite or disease entity terms	6
Drug names + parasite or disease terms + dog terms	5
Chemotherapy-Antiparasitic Agents + parasite or disease terms	14
Chemotherapy-Antiparasitic Agents + parasite or disease terms + drug terms	5
Toxicology-Veterinary + drug names + dog terms	8

TABLE 6. Computer Search: Heartworm Infections in Dogs and Treatment, 1974-1978. Retrieved References

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63011983
EFFECT OF DI-ETHYL CARBAMAZINE ON INDEXES OF FERTILITY IN THE MALE DOG
COURTNEY C H: NACHREINER R F
AM J VET RES 37 (9). 1976 1095-1097, CODEN: AJVRA
DESCRIPTORS: HEARTWORM INFECTIONS SPERM QUANTITY MORPHOLOGY MOTILITY VIABILITY
CONCEPT CODES: *02506, 12100, *14506, 16501, *16504, *22002, 22100, *22504, *22508, *26506, *38510, *60504, 64016
BIOSYSTEMATIC CODES: 51300, 85765, 97100

63003704
CANINE HEARTWORM DIROFILARIA-IMMITIS
BENGIS R G
J S AFR VET ASSOC 46(4), 1975 (RECD 1976) 373. CODEN: JAVTA
DESCRIPTORS: AEDES-SPP ANOPHELES-SPP CULEX-SPP MANSONIA-SPP SOUTH AFRICA THIACETARSAMIDE DITHIAZANINE DI-ETHYL CARBAMAZINE ANTI PARASIT-DRUGS
CONCEPT CODES: 07508, 10060, 12100, 12504, *14506, 22002, *38004, *38510, *60012, *60506, *61000
BIOSYSTEMATIC CODES: 51300, 75314, 85765

77096033
ADVERSE DRUG EFFECTS PRECIPITATED BY MICROFILARIAE OF DIROFILARIA-IMMITIS
GARLICK N L
CLIN TOXICOL 9 (6), 1976 (RECD 1977) 931-992 CODEN: CTOXA
DESCRIPTORS: DOG COMPOUND 48-80 p METHOXYPHENETHYL METHYLAMINE-FORMALDEHYDE PRODUCT VINCOFOS DICHLORVOS DI-ETHYL CARBAMAZINE CITRATE SHOCK ANTI CHOLIN ESTERASE ACTIVITY BLOOD CLOTTING
CONCEPT CODES: 10060, 10064, *10808, 14504, *14508, 15002, *22002, *22504, *22508, *38004, *38510, *54600, 60016, *60506
BIOSYSTEMATIC CODES: 51300, 85765, 96000

75007374
CHEMO THERAPY OF FILARIASIS AND ONCHOCERCIASIS
THOMPSON P E: MCCALL J W: ZEIGLER J B: JOHNSON M D
PAPAEVANGELOU, GEORGE J: NINTH INTERNATIONAL CONGRESS ON TROPICAL MEDICINE AND MALARIA. VOL. 1. ABSTRACTS OF INVITED PAPERS. ATHENS, GREECE, OCTOBER 14-21, 1973. 329p CONGRESS PUBLICATIONS COMMITTEE: ATHENS, GREECE. 1973 (RECD 1974) 107-108 CODEN: 03655
DESCRIPTORS: ABSTRACT DOG LITOMOSOIDES-CARINII DIROFILARIA-IMMITIS ONCHOCERCA-VOLVULUS DI-ETHYL CARBAMAZINE LEVAMISOLE FENTHION SURAMIN METRIFONATE FURADANTIN FURAZOLIDONE TETRACYCLINE TRIMELARSAN ANTI PARASIT-DRUGS

TABLE 6. Computer Search: Heartworm Infections in Dogs and Treatment, 1974-1978. Retrieved References (cont'd.)

CONCEPT CODES: 10060, 12512, *15006, *15008, *22002, *22008, *38004, *38510, *60506, 64016
BIOSYSTEMATIC CODES: 51300, 85765

58059486
PROCEDURES FOR THE TREATMENT AND PREVENTION OF CANINE HEARTWORM DISEASE
COUNC VET SERV (USA)
J AM VET MED ASSOC 162 (8). 1973 660-661. CODEN: JAVMA
DESCRIPTORS: THIACETARSAMIDE DI-THIAZINE IODIDE FENTHION DI-ETHYL CARBAMAZINE LEVAMISOLE ANTI-PARASIT-DRUGS DIAGNOSIS
CONCEPT CODES: 10060, *12504, *12512, *14506, *22002, *22010, *38004, *38510, *60506
BIOSYSTEMATIC CODES: 51300, 85765

DISCUSSION

Several observations merit mention here:

1. *Generally speaking, there is a wealth of data beyond what one would expect to find from a narrow, discipline-oriented retrieval strategy.* The most simplistic form of search would be to address the 600-odd sub-sections of BA or the concept codes representing them.

2. *In-depth indexing permits access to the data base in a variety of ways, some unique to the BIOSIS system.* For instance, in the example cited one may access the data base taxonomically (*Canidae* and *Canis* for the dog family and genus or *Canis familiaris* for the particular genus and species). Also, one could use natural language terms such as dog, beagle, German Shepherd, Heartworm, Dirofilariasis, and the various drug names to search by subject classification. More specifically, the chemotherapeutic agents listed in Table 4 can be searched by generic name and a multitude of trade names, thereby giving more opportunity to locate references obscured by use of an unfamiliar drug term. This is particularly so where one is cited in a foreign publication and employs a local common name for the drug. Actually, each trade name represents another access point for the generic chemotherapeutic agent, the number of access points being potentially a function of the number of additional trade names listed.

3. *Serendipity plays a part in a good search strategy and can be promoted with the judicious choice of combined search terms.* After the selection and refinement of the search, from the tens of thousands of

"hits" retrieved initially in some categories to the few culled out from the various combinations of search terms (Tables 4 and 5), some selective recombining can be fruitful. When the original question is addressed, i.e., combining each of the forty-three drug names with each heartworm parasite or disease entity term and with each dog term, five pertinent references are found—a proverbial needle in a haystack! These references are listed in Table 6. However, if the term Chemotherapy-Antiparasitic Agents (originally containing 6,381 references) is combined with each parasite or disease term, the search yields fourteen references; if the dog terms are added, it yields the *same* five pertinent references previously described.

An examination of the remaining nine references reveals that six drug entities are described, different from the original forty-three drug terms; also, two papers deal with drug therapy for heartworm infections in *humans* and one involves a toxicological study. Again, the utilization of multivaried approaches to the BIOSIS data base yields rewarding, if not entirely expected, results.

4. *Retrieval of the desired references in the search may encourage the searcher to deal with a corollary aspect of the study which may not have been anticipated at the start.* If one searches the combined terms Toxicology-Veterinary, each drug name, and each dog term, the resulting retrieved references (Table 5) give a toxicological picture of the drug regimens described for the dog on the first search.

As a consequence of the basic strategy employed and the many varied access points available from in-depth indexing, specialty indexing, and cross-referencing practices, the example serves to illustrate that the BIOSIS data base can be a productive source of information to researchers in the animal health field.

SUMMARY AND CONCLUSIONS

There are a number of bibliographic information services for animal health researchers and practitioners to choose from, which will allow users to keep current and to search retrospectively what has been done in their fields of interest. One of these information services, BIOSIS, has been described briefly, and some of its unique and innovative features have been discussed. An analysis of BIOSIS' animal health coverage, as represented by the pertinent and applicable categories of the BIOSIS data base, was presented.

The elements of BIOSIS' service encompass printed reference publications, computer-derived printouts, magnetic tapes, and microfilm records. Utilization of this service—how and where to search various forms of the data base—was described and illustrated. BIOSIS' data base represents a major source of the world's life science literature and one which the animal health scientist or practitioner should consider in undertaking an effective search.

REFERENCES

1. H. Brodauf, et al., "Searching the Literature of Veterinary Science: A Comparative Study of Ten Information Systems for Retrospective Searches from January 1972 to December 1974," *The Veterinary Record* 101, 23 (December 3, 1977): 461-463.

2. Martha E. Williams and Sandra H. Rouse, eds., *Computer-Readable Bibliographic Data Bases* (Washington, D.C.: American Society for Information Science, 1976); Gordon Pratt, *Data Bases in Europe* (London: Aslib, 1975), pp. 11-12; Winifred Sewell, *Guide to Drug Information* (Hamilton, Ill.: Drug Intelligence Publications, 1976), pp. 112-151; NFAIS and International Federation for Documentation, *World Directory of Abstracting and Indexing Services* (Springfield, Va.: NTIS, 1977 (in press)).

3. NFAIS, op. cit.

4. William Campbell Steere, *Biological Abstracts/BIOSIS: The First Fifty Years* (New York: Plenum, 1976).

5. *Serials Sources for the BIOSIS Data Base* (Philadelphia: Biosciences Information Service, 1978).

6. Ibid.

ANIMAL HEALTH INFORMATION IN THE AGRIS* SYSTEM

Lida L. Allen and G. Dubois*

To do justice to this topic, one should at least make a personal visit to a dozen representative AGRIS centers and survey their documentation/information activities. Unfortunately, such a visit or survey by the staff of the AGRIS Coordinating Centre, on a full scale, was not possible in time for this symposium because of shortages of personnel and restraints in the budget. Thus this paper has drawn upon appropriate data collected by the study team as published in the *UNISIST Report on the Independent Appraisal of AGRIS*.[1] Some supplementary information was gathered both at the AGRIS Coordinating Centre and at the United States AGRIS participating center, the National Agricultural Library, Technical Information Systems, U.S. Department of Agriculture.

EARLIER STUDY

In 1974 a similar study, *Survey of the Existing Position in Veterinary Information and the Relationship of Veterinary Information to AGRIS,* was done by D. E. Gray.[2] The main purpose of that study was to review the availability of veterinary information in relation to AGRIS II—specialized comprehensive and cooperative information centers or network. But the author also dealt with the general problems relating to AGRIS I—worldwide bibliographic coverage of agricultural literature. It seems that the author looked at the problems only from the veterinary scientist's side and failed to address himself to the AGRIS participating country institutions and/or information specialists/librarians in veterinary science at large. Therefore, his recommendations are particularly appropriate for veterinary scientists, especially in the European Community, but not necessarily for the information users interested in general animal husbandry and industry.

However, it would be of interest to take a look at some of Gray's findings and recommendations before we get into a factual presentation of animal health information in AGRIS. The following are excerpts from the

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*AGRIS: International Information System for Agricultural Sciences and Technology

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summary and recommendations of his study:

> Summary:
>
> This report . . . is principally concerned with the needs of veterinary scientists for information.
>
> The coverage of veterinary information has been shown by two investigations to meet the needs of veterinary scientists comprehensively. The most important gap in subject coverage is . . . information concerning veterinary pharmacology and therapeutics. There is also a need for an information service covering veterinary economics.
>
> The record of much of the information required by veterinary scientists is available in machine readable form. There is great scope for improvement of veterinary information by the exploitation of this record . . . by repackaging . . . and SDI services.
>
> The needs of veterinary scientists are probably best satisfied locally by means of abstracts, reviews, etc. in the national veterinary journals.
>
> There are no specifically veterinary information problems in the developing countries. Some of their problems will be met by AGLINET.
>
> [In the authors' opinion, the study did not cover this aspect of the information problem well. AGLINET, if in operation, is a network of libraries which, by pre-agreement, will provide the user with hard copy or microform copy of the original document. But AGLINET is not a bibliographic nor an abstracting service itself.]
>
> Veterinary science . . . has, uniquely, comprehensive high quality English language title service as well as abstracting services in English and other languages.
>
> Recommendations:
>
> As veterinary information services are generally satisfactory . . . there would be no harm to deferring decisions on this sector (especially the AGRIS II type of activity).
>
> Work in the sector should be organized in three phases: a survey of present information services . . . ; further study of . . . improvement in the short term; and a study of the most effective way of organizing veterinary information.
>
> The veterinary component of AGRINDEX should be a small selection of the veterinary literature, chosen by mechanical means from existing information sources, with the requirements of agriculturalists other than veterinarians

in mind.

[This approach is too compromising of the existing information sources and not enough consideration is given to resolving the problems that AGRINDEX was initially designed to do, such as how to increase the coverage of the world agricultural literature which is not currently being covered by the existing information sources, how to generate infrastructure in information gathering and processing activities, and how to accelerate the transfer of appropriate technology among the AGRIS participating countries, especially the developing countries, etc.]

AGRIS AS DIFFERENTIATED FROM AGRINDEX

AGRIS

AGRIS is an information system designed for world-wide collection and dissemination of agricultural information and technology. Each AGRIS participating country shares the responsibility of contributing bibliographic citations to its own agricultural literature, and participates in decision-making, planning, and policy of the AGRIS operation. In turn the system enhances the exchange of information among the participating countries.

The Food and Agriculture Organization of the United Nations (FAO), through its AGRIS Coordinating Centre, acts as a facilitating mechanism within this world-wide information system. In AGRIS both the creation of the input and the utilization of the output of the system are completely decentralized, and rest with the individual participating countries.

The concept of AGRIS is set forth as reaching the following objectives:

- o To create a single, comprehensive, current inventory of world-wide agricultural literature contributed by the AGRIS participating countries, which covers research results, food production experience, food supply, agricultural economics, rural development, natural resources, and environmental impact;
- o To meet technical information needs of agricultural workers, researchers, and administrators of the participating countries through the existing libraries and information centers as in the case of an indistrialized country, and through enhancing the development of libraries and technical information activities in developing countries;
- o To interact with new and/or existing secondary specialized information services so as to increase efficiency and eliminate unnecessary duplication.

AGRINDEX

The most visible product of the AGRIS program is a bibliographic publication, AGRINDEX, in printed form and on magnetic tape. AGRINDEX contains bibliographic citations contributed by more than one hundred national and multinational participating centers. The input is received and processed at the AGRIS Input Unit, a sub-unit of the AGRIS Coordinating Centre, located at the International Atomic Energy Agency in Vienna, Austria. Modern computer techniques are used to process the raw input data, update the records, and finally to generate camera-ready film through photocomposition programming.

AGRINDEX appears once a month, with an average of more than 10,000 citations per issue, of which one-sixth are non-conventional literature. The citations are arranged by seventeen primary and sixty-nine secondary subject categories and, within each category, by commodity codes. Each issue of AGRINDEX contains a personal author index, a corporate entry index, a commodities index, and a report and patent number index.

Since AGRIS is an information program and AGRINDEX is a product of AGRIS, the two acronyms have often been used interchangeably in the past. However, in this paper animal health information is to be discussed in relation to AGRINDEX rather than to AGRIS. In addition, the interpretation of animal health will be expanded here to include information on animal production and industry as well. The reason for the expansion is because in AGRINDEX animal health is a part of the primary category, Animal Production. Although there are four secondary categories (veterinary science and hygiene, pests of animals, animal diseases, and miscellaneous disorders of animals) under Animal Production directly relating to animal health, other secondary categories such as animal nutrition, feed microbiology, animal physiology, etc. could also contain pertinent information relative to animal health. Thus, the following discussion will focus on animal production information in AGRINDEX.

COVERAGE OF ANIMAL PRODUCTION LITERATURE IN AGRINDEX

There are seventeen primary subject categories in AGRINDEX covering the broad field of agricultural literature. Second to Plant Production (average twenty-seven percent input), the category with the next highest number of citations represented in AGRINDEX is Animal Production (24.61 percent of the total input citations). (See Table 1.)

As shown in the *UNISIST Report* the amount of information in the Animal Production category has been remarkably constant in the first two volumes of AGRINDEX, averaging twenty-four percent of the total number of citations. In the ensuing twenty-one months the percentage remained almost the same—24.61 percent. Thus animal production represents one-fourth of the total agricultural literature.

TABLE 1. Citations on Animal Production

Code	Subject Category	No. of Citations	Rank
L00	Animal production (general)	8,117	5
L05	Animal science	677	14
L10	Animal breeding	11,509	4
L20	Animal ecology	2,734	9
L30	Animal nutrition	12,420	2
L32	Feed processing	1,002	13
L34	Feed microbiology and toxicology	268	15
L36	Feed composition	1,390	12
L40	Animal structure	2,285	11
L50	Animal physiology and biochemistry	13,672	1
L60	Animal taxonomy and geography	2,292	10
L70	Veterinary science and hygiene	5,314	8
L72	Pests of animals	7,515	7
L73	Animal diseases	11,975	3
L74	Miscellaneous disorders of animals	7,862	6
	TOTAL	80,911	

Total citations in AGRINDEX vol. I-IV (9), 1975-Sept. 1978: 328,796

Animal production represents 24.61 percent of the total.

Furthermore, the *UNISIST Report* reveals that the subject distribution of the AGRINDEX citations is consistently biased toward two categories, Plant Production (average twenty-seven percent of the total) and Animal Production (average twenty-five percent of the total).[3]

However, when the separate countries' inputs are examined, the same trends are noticed. There are four countries and one region which produce more citations in animal production than in plant production and in another four countries the citations on animals are the second highest category. They are as follows:

Australia	31% Animal Production	25% Plant Production
Czechoslovakia	34% Animal Production	31% Plant Production
U.S.A.	28% Animal Production	24% Plant Production
Yugoslavia	31% Animal Production	27% Plant Production
EEC	29% Animal Production	23% Plant Production

Japan	19% Animal Production	31% Plant Production
Spain	24% Animal Production	31% Plant Production
Sweden	21% Animal Production	27% Plant Production
USSR	32% Animal Production	38% Plant Production

In general, the industrialized countries put out more literature concerning animal production than the developing countries. (See Table 2.) It will be noticed that there are some countries in which animal husbandry is a predominant part of the agricultural economy which provide markedly few citations.

TABLE 2. Animal Production Citations by Country, in Order of Rank, Found in AGRINDEX, Vol. I-IV (9), 1975-Sept. 1978

Country	No. of Citations	Country	No. of Citations	Country	No. of Citations
United States	19,904	New Zealand	539	Zaire	48
United Kingdom	8,913	Indonesia*	437	Guatemala*	47
Japan	4,925	Poland	433	Iraq	41
Germany, F.R.*	4,293	Argentina	421	Morocco	30
Italy*	3,494	Egypt	406	El Salvador*	28
France*	3,030	Chile*	368	Trinidad & Tobago*	22
Australia	1,921	Philippines*	275	Hong Kong**	20
Czechoslovakia	1,757	Romania	270	Panama*	20
Netherlands*	1,465	Ireland*	190	Bolivia*	19
Denmark*	1,457	Colombia*	156	Honduras*	16
Spain	1,388	Korea, Rep. of*	143	Cyprus	11
India	1,327	Costa Rica*	132	Norway	10
USSR	1,233	Malaysia*	131	Zambia	9
Yugoslavia	1,217	Thailand*	114	Sri Lanka	6
Bulgaria	873	Finland	105	Sudan	5
Mexico*	847	Uruguay*	98	Libya	4
Belgium*	736	Israel	70	Madagascar	4
Canada	731	Hungary	66	Jamaica*	3
Brazil*	649	Ecuador*	55	Nicaragua*	2
Sweden	578	Tunisia	50	Pakistan	2
Venezuela*	564	Peru*	49	Algeria	1

*Citations submitted prior to 1976 are not included.
**Special territory

INTERNATIONAL LIVESTOCK CENTRE FOR AFRICA (ILCA)

In December 1977 ILCA joined AGRIS as the first participating member from the CGIAR (Consultative Group on International Agricultural Research) institutions. It is interesting to note that this center has put "documentation and information services" at the same level as its research and training activities. Such a priority assigned to a technical information program is seldom seen in research institutions. ILCA probably gives proportionately the most emphasis to library and information topics of all the eleven CGIAR institutions.

The following paragraphs are extracted from the *Proposed Program and Budget 1978* of ILCA.

> Documentation and Information Services continues to grow. The central library now includes some 6,000 items, with new accessions accumulating at a rate of about 200 per month. Of the total accessions, 5% have been by donation, 45% by subscription and 50% by acquisition by ILCA's own staff. ILCA staff have now visited centres in Ethiopia, Kenya, Mali and Senegal, on the invitation of the governments concerned, and have collected on microfiche a substantial body of literature from departmental libraries and files, much of it unpublished and unavailable other than to a handful of workers. More such visits are planned, with emphasis on collecting literature of immediate relevance to the areas and livestock production systems currently under study.
>
> In terms of input, the above activities occupy about half of available staff time. The translation of documents and the preparation of bibliographies and literature reviews each occupies about 10% of staff time. The remainder of staff time is devoted to administrative duties and to preparing documents for dispatch to interested agencies, mostly in Africa. Major consignments of documents on microfiche (2,200 microfiche in total) have already been sent to institutes in Ethiopia, Kenya, Mali and Senegal. Progressively it can be expected that an increasing proportion of the effort will be devoted to translation, bibliographies and dissemination.[4]

Participating in AGRIS is one of the more efficient ways for ILCA to communicate with the world agricultural communities. At the same time AGRINDEX users can gain direct access to ILCA's published and unpublished research results.

CONCLUSION

1. AGRIS has, even during its developmental stage, enhanced the exchange of agricultural science and technology information among participating

countries, and has encouraged the buildup of an indigenous infrastructure of information/library facilities to serve local needs.

2. AGRINDEX contains a high proportion of non-conventional literature (approximately one-sixth of the total data base) and a higher rate of bibliographic references (one-fourth) in animal production.

3. A campaign to enroll international agricultural research institutions will further the AGRIS course. An example which has proved rewarding is the membership of ILCA in the system.

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VETERINARY LITERATURE DOCUMENTATION AT THE COMMONWEALTH BUREAU OF ANIMAL HEALTH

Roy Mack*

The "animal" side of the Commonwealth Agricultural Bureaux (CAB) comprises individual units on animal health, animal breeding, nutrition, dairy science, helminthology, entomology, and mycology. Consequently there is an overlap between the animal health bureau and neighboring fields of veterinary interest (Figure 1).

At the Commonwealth Bureau of Animal Health (CBAH) in Weybridge, England, we have a staff of seven information scientists, four typists, and supporting library, computer processing, and administrative staff; also a panel of twenty outside abstractors. Our monthly abstract journal, *The Veterinary Bulletin,* contains about 7,000 abstracts a year, while our title-only service, *Index Veterinarius,* contains about 20,000 items a year, and is issued as monthly parts with a cumulative annual edition. A list of the 1,226 serial publications scanned for this purpose is available[1] but it must be stressed that we deal with all types and categories of literature, not just the conventional periodical literature.

Magnetic tapes from our publications are available from 1972 (because we operated the pilot mechanization project prior to the mechanization of CAB in 1973), and at the moment 125,000 items are available, including 45,000 abstracts. This material is available as part of File 50 (*CAB Abstracts*) in the Lockheed DIALOG system, and will soon become available through the EURONET telecommunications system as well (Table 1).

TABLE 1. CAB Abstracts, Animal Part: Number of Items on File between January 1973+ and July 1978.

Animal Health	124,552 (*Index Veterinarius*)		
	44,683 (*The Veterinary Bulletin*)		
Animal Breeding	32,618	Entomology (med./vet.)	17,575
Dairy Science	38,603	Mycology (med./vet.)	11,494
Nutrition (animal)	46,599	Protozoology (from 1977)	6,921
Helminthology	30,997		

+January 1972 for Animal Health

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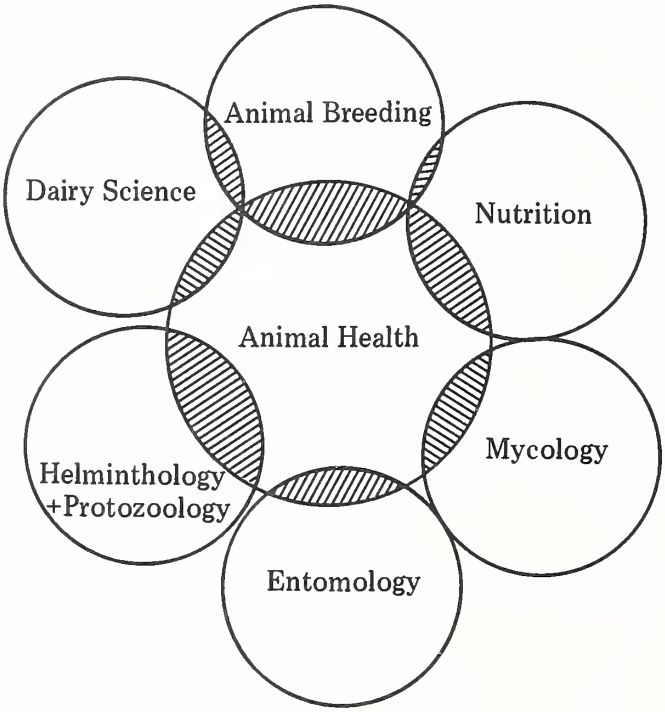
FIGURE 1.

COMMONWEALTH BUREAU OF ANIMAL HEALTH
Overlap with other units of CAB



The Bureau is financially self-supporting, with most of its income derived from printed publications. Although income from online royalties is increasing steadily, it will not become a significant source of income for some time to come.

ROLE OF THE INFORMATION SCIENTIST

Since the quality of documentation depends on information scientists, it is worth while to examine the sort of burden that is placed on them. This takes the form of rapid decision-making, and the remembering of large numbers of terms and their equivalents in other languages; also an awareness of the subject scope and the procedure to be followed.[2] The scanning procedure involves the following decisions and actions (see Figure 2):

1. What publication?
   Not all publications are straightforward journals. Bibliographical particulars may have to be decided upon.

2. In scope?
   We have a major difficulty here in deciding if a given item is within the wide range of interests of the veterinary profession. Principal criteria are animal diseases; domestic animals in relation to biomedical sciences; veterinary profession.

3. Title translation?
   Linguistic specialists required; consultation of dictionaries.

4. Enrich title?
   Many titles are still so uninformative that we have to add an explanation of what they are about, or what species of animal is dealt with.

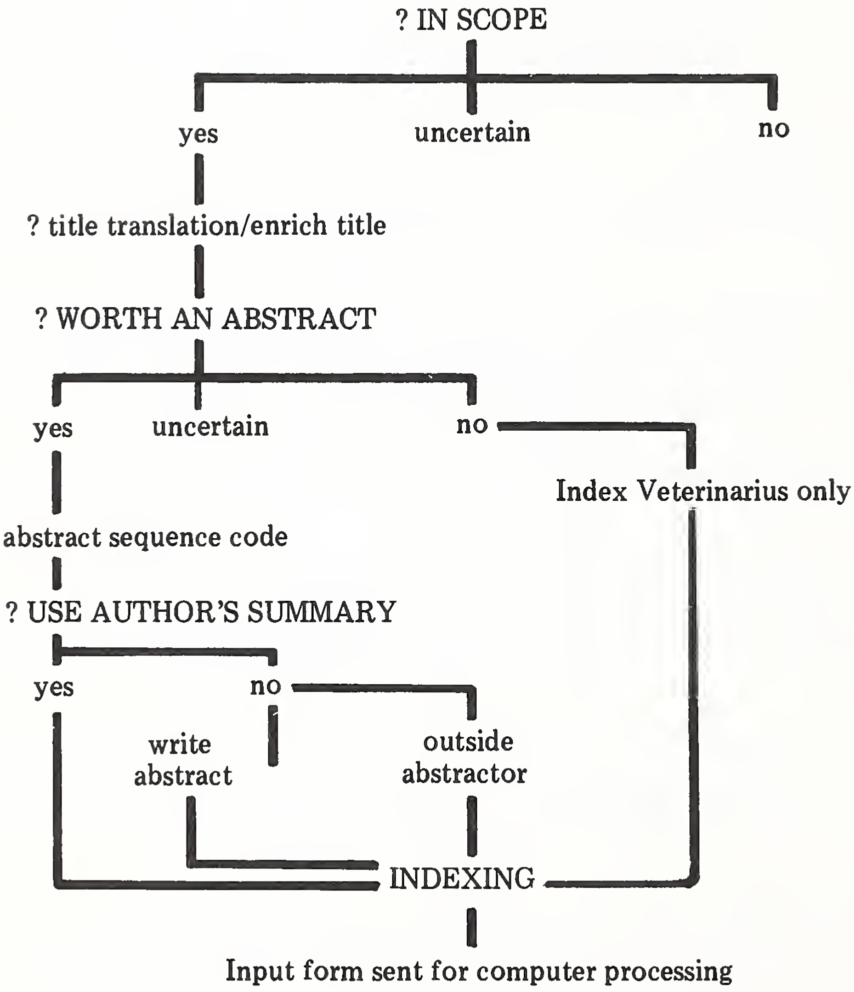
5. Required for AGRIS?
   Allocate AGRIS subject and geographical codes. (We are responsible to AGRIS for veterinary literature originating in the United Kingdom, Canada, New Zealand, and Bangladesh.)

6. Abstract or title only?
   This can be a difficult decision to make (see Table 2). If an item is selected for abstracting, it will require an abstract sequence code number. The next decision is whether to instruct the typist to copy the author's summary (about 60% of our abstracts), whether to write an abstract on the spot, or whether to refer it to an outside abstractor.

7. Indexing terms?
   Allocate terms selected from the CBAH controlled vocabulary of 4,337 descriptors, divisible into (1) entries for the printed indexes, and (2) additional terms to facilitate retrieval from

FIGURE 2.

Decisions in literature documentation



magnetic tape.

It should be obvious from the above that persons having an exceptional combination of qualities are required for documentation work, and it would be quite wrong to think that documentation can be left to clerical assistance and a computer.

TABLE 2. Types of Publications Not Usually Selected for Abstracting, but Listed in *Index Veterinarius* by Title Only.

- Marginal fields of veterinary medicine, such as history and jurisprudence
- Abstracts of conference papers
- Chapters in books
- Case reports, i.e. reports of single cases
- Minor items of literature, such as correspondence, notes, obituaries
- Brief review articles, particularly those in difficult languages
- Extension literature written for students and farmers
- Related fields in other biological sciences, such as pure microbiology (but dealing with a pathogen of domestic animals), general parasitology, general pathology
- Literature of purely local interest, describing veterinary affairs within a small area
- Repetitive literature, duplicating previous reports; small trials of a drug or a method that has become well established
- Publications received too late for abstracting

CONTROLLED VOCABULARY

No documentation system can operate indexing and retrieval at high efficiency without using standardized terms to describe its main subjects. At the Commonwealth Bureau of Animal Health a rigidly controlled vocabulary of about 1,800 terms was in use between 1931 and 1971. The change to computerized processing offered an opportunity to improve and expand this vocabulary, which led to the publication of *Veterinary Subject Headings* in 1972 (3,436 descriptors). Now this, in turn, has been replaced by the *Veterinary Multilingual Thesaurus* of 4,923 descriptors, produced under the "ASTUTE" thesaurus program of the Directorate-General for Scientific and Technical Documentation and Information, European Commission, Luxembourg. It involved three and one half years of work by a small group of veterinarians from England, France, Germany, and Italy representing the Round

Table for Veterinary Documentation. This thesaurus is now in use at the CBAH and the printed version is due to appear soon. Provision has been made for regular updating.

WHY USE A THESAURUS?

As many persons engaged in documentation are sceptical about the value of a thesaurus (partly because of the labor involved in producing one), I offer the following advantages:

1. It is an invaluable aid to the information scientist who has to allocate indexing terms.

2. Equally, it benefits those engaged in retrieval.

3. Entered in an online system, portions of hierarchies can be searched as an alternative to alphabetical indexes.

4. It provides a concise guide to current nomenclature, such as drugs, chemicals, and parasites.

5. A multilingual thesaurus enables a person to use a data base in another language, and offers the possibility of machine translation.

ONLINE SERVICES

A controversial point is whether it is an advantage or a disadvantage to be able to search the text of abstracts, as in the *CAB Abstracts* file. The disadvantage is false combination of terms, while the advantage is the ability to retrieve terms such as species or drug names not mentioned in the title or the indexing. Fortunately it seems likely that online systems do, or will, include the option of omitting the abstract from the searching procedure. It is, of course, still very useful to be able to obtain abstracts in the printout. It is worth mentioning that many abstracts contain data which could be retrieved if suitably tagged or labelled.

Online experience has certainly modified our approach to indexing, and we are including extra terms to facilitate retrieval. Because the thesaurus has not yet been incorporated into an online system, we feel it is necessary to include certain broader terms in order to answer questions of a general nature. Examples are "cattle diseases," "viral diseases," "antibiotics," "antiparasitic agents."

UNFILLED NEEDS

We are unable to fulfill the needs of users for

1. Fact retrieval—a task for data banks;

2. Digests of information for practicing veterinarians (done to some extent by national veterinary organizations, but not systematically);

3. Reference books and up-to-date textbooks—a neglected field, because too few subject experts have time to write books.

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2. R. H. Richens, "Mnemonic Load." Unpublished paper presented to the CAB Staff Conference, December 1977. Author's address: Commonwealth Bureau of Plant Breeding and Genetics, Pembroke Street, Cambridge, U.K.

THE EMERGENCY PROGRAMS INFORMATION CENTER (EPIC)

Gary P. Combs*

Emergency Programs is that component of Veterinary Services, Animal and Plant Health Inspection Service, United States Department of Agriculture, which has the responsibility for predicting and preparing for animal health emergencies. When a National Emergency is declared by the Secretary of Agriculture, Emergency Programs takes command of the necessary elements of the regular animal health organization (Veterinary Services) to achieve disease eradication. This group is a rapid-reaction force whose nerve center is located in Hyattsville, Maryland. This Emergency Program Information Center (EPIC) was established in 1972 under the guidance of the first Director, Dr. R. E. Omohundro. EPIC was designed as a unique facility containing a modern conference room, communication equipment, audio-visual aids, television studio, map storage facility, and literature data bank. Thus, EPIC is actually a "war room" against animal diseases.

The first step in making EPIC operational was to prepare a list of priority exotic animal diseases. Then it was the responsibility of Emergency Programs to develop plans of action before these diseases gain entry into the United States.

CRITERIA

Knowledge of the priority diseases was necessary to develop these contingency plans. A decision was made to establish a literature data bank which met the following criteria: (1) the information must be stored in a compact manner and be rapidly retrievable; (2) information must cover the entire disease from the time of identification to the present time; (3) all articles must be in English or, if in a foreign language, translated into English; (4) the entire article must be included, not just the abstract; (5) information must be filed by disease in such a way that articles are not lost or misfiled, and information contained must be retrievable in a manner compatible with the needs of an emergency animal disease task force; and (6) the articles must contain information on the disease itself. In addition, the system to be established had to be

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flexible, reproducible, capable of expansion, and capable of serving the needs of its users. After investigating several systems of information retrieval, a combination of computer and microfilm was considered the most likely to meet Emergency Programs needs.

SYSTEM

At the heart of the entire literature and data retrieval system is a controlled vocabulary of over 4,000 key concepts associated with animal diseases arranged in a thesaurus both alphabetically and hierarchically. Each key concept is identified in the thesaurus with a six-digit number which is used for encoding and retrieval operations. This thesaurus is constantly expanded as new key concepts are encountered. Initially, the thesaurus was based on the Commonwealth Agricultural Bureaux' "Veterinary Subject Headings."

Most article citations or references are obtained from computerized data systems available, e.g. BIOSIS, Commonwealth Agricultural Bureaux' *Veterinary Index*, *Chemical Abstracts*, *Index Medicus*, etc. Since most of these computerized services became available in the late 1960's, additional bibliographies from review articles, researchers, etc., are utilized to obtain older citations on animal diseases. Citations are checked against current holdings for duplication, and the article is acquired through the National Agricultural Library and the international library network. The article is then carefully read by coding and indexing specialists with biological backgrounds. Concepts are noted and correlated with similar keywords or phrases listed in the thesaurus. The code numbers are recorded on a code sheet which also includes standardized bibliographical information. The code sheet, in effect, summarizes information contained in the article for use in emergencies. Each article is given an individual number and all articles on a specific disease are numbered in sequence.

After an article has been read, coded, and numbered, the code sheet and the entire article are microfilmed on 16mm roll film at a reduction ratio of 24:1. After processing, the film is edited for errors and the original film is stored. A positive silver copy utilized as a print master is made, and all subsequent copies come from this copy. The articles are microfilmed in numerical sequence on 16mm roll microfilm. The "use" copy is placed in a plastic cassette for storage and retrieval. Each roll of film contains approximately 150 coded articles. A roll may be automatically searched by the microfilm system in thirty seconds to determine if any of the articles contain desired information. When a copy of an article is needed, the equipment can reproduce a paper copy enlarged to original size.

Articles in languages other than English are sent out for translation. Usually one year or more is required for an article to be translated, returned, and incorporated into the system. Currently, 16,000 pages are translated each year.

To speed retrieval capability further, the key concept codes of each article, along with the article's bibliographic information, are entered into an online computer. The computer can screen thousands of articles on a given disease and locate citations and article numbers concerning many key concepts in a matter of minutes. It is a simple procedure to secure the articles from the microfilm file by number. An added advantage of the computer is that all articles on each disease can be arranged alphabetically by author and printed with their complete citations. A bibliography can be readily produced by the computer for distribution. The input into the computer is compatible with the AGRICOLA system of the Technical Information Systems, Science and Education Administration. At the present time the disease, brucellosis, is a subfile of AGRICOLA.

The Emergency Programs data bank or literature retrieval system makes it possible to store a large amount of reference material in a small space and to obtain detailed disease information in a matter of a few minutes. One of the more rapid methods of transmitting the recovered information to field locations is through the use of a facsimile machine or telecopier system. As an adjunct to the system, selected review articles may be assembled as microfiche. Black and white or color microfiche of articles or disease lesions can be distributed to field personnel.

Although the initial costs of retrieving citations and articles, reading, coding, and indexing the articles are relatively high, computer tapes and microfilm copies can be reproduced at a fraction of the cost of the initial input.

At the present time, over 28,000 articles on nineteen animal diseases are in the EPIC data bank. Bibliographies have been produced on foot-and-mouth disease (4,032 citations), Newcastle disease (2,470 citations), African swine fever (900 citations), swine vesicular disease (243 citations), Venezuelan equine encephalomyelitis (739 citations), vesicular exanthema (243 citations), trypanosomiasis (2,852 citations), ephemeral fever (113 citations), visna-maedi complex (275 citations), bluetongue (430 citations), and pseudorabies (436 citations). Other programs in Veterinary Services also use the data bank, and some endemic diseases have been added. These are brucellosis (3,196 articles), pseudorabies (545 articles), bluetongue (790 articles), vesicular stomatitis (2,112 articles), Newcastle disease (3,906 articles), and San Miguel sea lion disease (48 articles).

Map System

In animal disease outbreaks, maps are needed in a variety of sizes and scales. When an area of the country experiences an exotic disease, a number of maps of a single area are needed rapidly. A map storage and reproduction system has been established in EPIC. The system reproduces the maps on 35mm microfilm and these are mounted on aperture cards. The cards are stored in a manual system by state or by serial number. Indexes of a given series allow the proper map to be selected. The maps are reproducible by photo enlargement back to 24 x 36 inch size at the rate of two maps per minute. Currently, there are over 3,000 county maps of the United States

in the system as well as over 30,000 geological survey maps of the United States and aeronautical maps of all areas of the world.

Communications

Communications in EPIC are handled by telephone, telex, telecopier, telegram, and mail. Information, depending upon the speed needed, can be sent and received in a variety of ways.

Audio-Visual

EPIC has a bank containing over 5,000 two-by-two-inch transparent color photographs on exotic animal diseases. These are filed by disease and are available for rapid selection and inclusion into presentations. There is a capability of storing 10,000 original slides and 70,000 copies in the system.

A television recording station is also a part of EPIC. Video-tape recordings provide presentations for use at various training courses, exhibits, and field stations throughout the United States. A motion picture file is maintained which contains most of the available films on exotic animal diseases.

FUTURE PLANS

Our future plans include the continued addition of exotic diseases to the data bank, continued updating of disease information, periodic publication of bibliographies of the diseases in the data bank and their worldwide distribution, the addition of articles on endemic food-animal diseases, the sharing of both the computer and microfilm components of the data bank on a cost basis with other countries of the world, and the addition of all EPIC citations and index terms into the AGRICOLA computer system of the National Agricultural Library.

A color catalog of the color slides in EPIC's slide bank is planned. Once designed and printed, this catalog will be loaned out to allow the visual selection of desired slides which can then be ordered at cost.

TWO SOURCES OF BIBLIOGRAPHIC INFORMATION ON AQUATIC ANIMALS

Elaine V. Collins*

If your field of interest includes aquatic animals, there are two relatively little-known sources of bibliographic information which are available. Both are part of a one-stop information service called OASIS (Oceanic and Atmospheric Scientific Information System). The two sources to be described are included in a publication titled "User's Guide to ENDEX/OASIS," available from the Environmental Science and Information Center (ESIC), OA/D8, Rockwall Building, 11400 Rockville Pike, Rockville, MD 20852.

The first automated information base is called the Marine Biological Information Retrieval System (MBIRS). It is the older of the two bases and deals only with marine life. It contains approximately 25,000 indexed references to environmental effects on marine plants and animals published from 1955 to 1974. All entries were indexed from a thesaurus of 800 fixed terms plus open-end terms (e.g. identification of specific diseases). Of the 1,100 entries indexed to the general term "pathogenesis" many refer to specific diseases and parasites. For instance, in Figure 1 the first example refers to the specific effects of lymphocystis in striped bass and the second describes the effects of a copepod parasitic in mussels. As can be readily seen, each bibliographic reference in the file includes date of publication, authors, title, and journal or book citation, plus the appropriate subject terms and identification of specific organisms to major taxonomic group (usually class or order), family, and genus without species. In addition two types of coded geographic locations are used to denote larger and smaller ocean areas. For example, NA refers to North Atlantic and in the 10-degree coordinate system of Marsden, square 116 (with 5-degree square no. 4) includes the Chesapeake and Delaware Bays. Approximately ninety percent of the articles are in English. The file was closed after 1974 publications because of lack of funds and increased pressure on available personnel to do other work.

The second automated information base is probably the more useful of the two bases to those among you interested in aquatic life, be it fresh-water or marine. The base is called the National Aquaculture Information System (NAIS) and it was developed in answer to a need for a centralized source of information concerning the culture of aquatic organisms. Probably the two most important aspects of aquaculture right now are disease and nutrition.

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FIGURE 1. Typical Entries in MBIRS

017017 1970
KRANTZ, G.E.
LYMPHOCYSTIS IN STRIPED BASS, ROCCUS SAXATILIS, IN CHESAPEAKE BAY
CHESAPEAKE SCI. 11 (2), 137-139
CODED GEOGRAPHIC LOCATION NA
MARSDEN SQUARES 1164; 1160
DESCRIPTORS SC-ET; SC-PD; SC-PA; SC-PH; BAYS; ESTUARIES; STREAMS; COASTAL; NEKTON; DISEASE NAMES: LYMPHOCYSTIS; HISTOLOGY; OSTEICHTHYES; ROCCUS; SERRANIDAE
LANGUAGE CODE E

008340 1970
CAMPBELL, S.A.
THE OCCURRENCE AND EFFECTS OF MYTILICOLA INTESTINALIS IN MYTILUS EDULIS
MAR. BIOL. 5 (1), 89-95.
CODED GEOGRAPHIC LOCATION NA
MARSDEN SQUARES 1810; 1811
DESCRIPTORS SC-PA; SC-DR; SC-PD; SC-RE; SC-MO; ENDOPARASITES; PARASITISM; BENTHOS; BREEDING TIMES; STARVATION; MYTILICOLA; CYCLOPOIDA; COPEPODA; MYTILUS; PELECYPODA
LANGUAGE CODE E

The aquaculture file contains approximately 5,000 references, mostly published since 1970, and indexed with the aid of a specialized thesaurus developed for the project. The thesaurus is arranged with broader, narrower, and related terms. Under the term "disease" in the thesaurus there are listed seventy-six narrow terms relating to specific diseases and conditions, from anemia to white wasting disease. Related terms include disease control, diagnosis, mass mortality, and virulence. Additional specific disease names are added to the file as needed. The file is neither exclusive nor exhaustive, but it does provide a very good foundation for individuals interested in, contemplating, or enmeshed in the culture of aquatic animals. One hundred new references are added to the aquaculture file per month to keep the system up to date. The majority of articles are in English (either as originally written or as translations).

Information from either file can be obtained by requesting it from the National Oceanographic Data Center, NOAA/Department of Commerce, 2001 Wisconsin Avenue, N.W., Washington, DC 20235, or from ESIC (see address above). The information requested or the problem to be resolved should be stated in the terms most comfortable to you. It is unnecessary to worry about the specific thesaurus terms which might be available. Whoever receives the question should be able to translate it into the terms the computer will understand.

Unfortunately, there is a bad side to all this good news. The first bad news involves the cost of doing retrospective searches. Such searches are charged at the rate of $15 for MBIRS and $10 for NAIS. Selective Dissemination of Information (SDI) searches are not done routinely. The second bad news, considerably more serious than the first, involves transferring the two files to a new computer system. The specific changes which will have to be made are unknown at this point.

THOUGHTS ON THE IMPROVEMENT OF LITERATURE INFORMATION

Hans Brodauf*

A comparative study entitled *Searching the Veterinary Literature Retrospectively* was prepared in my department at the Veterinary College in Hanover. Ninety test questions which had been asked by veterinarians from the partner countries of the European Communities were used to interrogate ten data bases. We received 73,954 references, which were then submitted to the interrogators for evaluation as to relevance. The result is in print.[1] I have been requested to express myself on proposals for improvement from the viewpoint of this study

I am assuming that *veterinary science* is a synonymous term for the *science of veterinary medicine*, and is thus the branch of the profession which is concerned with the curative and preventive aspects of animal health. Veterinary medicine must be regarded as an independent field of science, but with multidisciplinary aspects; in other words, veterinary science can be applied in adjacent sciences wherever the animal plays a role, whether it be in the agrarian sphere in animal breeding and husbandry, in nutritional science in the animal product, in zoological equipment, in experimental animal science, in model medicine, in drug research, or with regard to animal wastes in environmental hygiene.

Therefore, both the veterinarian himself and professional representatives in the adjacent fields have a need for information in veterinary literature. Accordingly we also find data which are of interest to the veterinarian in the information systems, i.e. data bases, of the adjacent sciences. However, veterinary information in adjacent fields is only of interest to the extent that it is useful in the veterinary sphere. We have demonstrated this very clearly in the European Communities study and have formulated the result as follows:

1. Each data base examined contained information relevant for veterinary medicine.

2. None of the data bases examined could give complete veterinary medicine information; in other words, each data base was, within the scope of its concept, in only a limited position to give out veterinary medicine information. Some of the ninety questions also remained unanswered by the data bases.

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3. Nevertheless, the data bases were able to supplement each other. Thus, the veterinarian will have to interrogate several data bases in order to satisfy his information requirements.

4. According to his field of activity, the veterinarian also needs information from the respective adjacent sciences.

This extension of the need for information is expressed in the study by the fact that the interrogators also designated as relevant information that was not markedly of a veterinary nature. With regard to the *technical development of information processing and information dissemination,* we are of the opinion that there needs to be an optimization of information performance in two ways: by having access to each data base approximately as provided by EURONET planning, and by the stored information being recallable in a meaningful and relevant manner.

The interrogators pleaded in a purely formal way for information on abstracts. First of all, we would regard it as desirable that all data bases be made uniform as to the output form, with a uniform method of recording the authors and journal titles or their abbreviations. In the formulation of the results I attached great importance particularly to two findings, namely *double work* and *ballast*. In my opinion, they are the most suitable for initiating reflections on the improvement of information.

Improvement of information depends, of course, also on the user of the data base. In our study, questions were introduced whose formulation presented difficulties for the search strategy and whose translation into English or French was partially defective. It seems to be especially important that there be contact between data base and interrogators in order to reformulate or delimit the question if the occasion arises. This in itself would help to reduce the accumulation of ballast and improve the rate of accuracy.

A great deal of ballast certainly occurs because insufficiently specific descriptors are available for non-veterinary data bases, so that search concepts must be narrowed down by postcoordination. *Index Veterinarius* has obtained the best accuracy. I attribute this to indexing with professionally specific subject headings. VETEC has therefore prepared a thesaurus for veterinary medicine. My colleague, Mr. Mack, has reported on the VETTERM enterprise. The thesaurus is written in four languages for European purposes in order to prevent the above-mentioned translation errors during the formulation of research questions, for good indexing certainly has effects on retrieval.

I am acquainted with the efforts at *machine indexing*. First of all, we have decided for professional reasons that the surest way of obtaining a good result in professional indexing is still a matter of intellectual performance. Our demand goes even farther. We want indexing to be in the hands of the professionally oriented documentarian. This and the use of the veterinary thesaurus would contribute substantially to the elimination of ballast. This method is used by the AGRIS model. Moreover, there may be linguistic obstacles because documentation comes from disparate

nationalities. Information availability, even with the use of machine indexing, could indeed be improved by editing if it became possible to formulate the titles of articles in controlled thesaurus terms. I can point to the bad habit of authors, at least in the German-speaking area, who continually try to introduce into the vocabulary new synonyms which considerably impede indexing.

The second problem in the rationalization of information performance is double work. The appeal in the 1964 vineyard report to limit double work has not succeeded. It exists in the form of the parallel formulation of articles and also in the form of the evaluation of the same journals, to be sure according to a different method of selection. On the one hand, we found about twenty-five percent of accepted articles duplicated. On the other hand, we received from several data bases different articles from the same journal on the same question. Thus, the same journal had been subjected to variable selection by the data bases according to each professionally oriented point of view. Our finding that several data bases could supplement each other, and so complete the veterinary medicine information requirement, can now be made to fit into the following reflection.

When it is technically possible to have access via an information network to every data base, then it is no longer necessary for them to allow themselves the luxury of extending the journal list according to their own judgment because one or another marginal sphere has become interesting in the meantime. When each profession indexes its scientific contribution according to its field and the subject, and makes the latter available for general information, the information is then optimized with regard to content, and its utilization is rationalized. Instead of an extension of the journal list, there could be a reduction of the journals to be evaluated. The released professional workers could then be used to work their own professional literature from cover to cover, for selection is equivalent to information loss. A critical examination of the list of journals in the study shows, for example, that *Index Veterinarius* could have fulfilled sixty percent of the requirement of veterinary medicine for information in the study if the journals had been evaluated from cover to cover. Actually, *Index Veterinarius* contributed only twenty percent of the information, with half being duplicated by other data bases.

Having been subsequently requested to express my opinion about ways to improve information performance, I regard rationalization of input as the most important step, followed by optimization measures for inclusion and indexing.

1. Every *data base* should be restricted to the evaluation of the literature of a carefully delimited profession—i.e., the cooperating data bases would have to synchronize the *coverage*.

2. The *documentarian* should belong, to the extent this is possible, to the profession for which the data base is operated. Moreover, documentation will be more complete and freer of linguistic and grammatical errors if each country formulates its own literary

contribution and delivers it to *input.*

3. The *data bases* should include a uniform *output form.*

4. The *editorial staffs* should pay heed to retrievable formulations of the articles and should influence the authors to write summaries in the form of structured *abstracts.* With inclusion of abstracts, it would be possible even to improve machine indexing, so that the professional documentarian could possibly be saved.

5. *Authors* should resist the craze for synonyms in creating the title and instead use thesaurus concepts.

6. *Users* of data bases should be introduced, at an early stage of their education, to working with information systems, just as every student is introduced to library science.

7. Finally, as a concluding remark, I know that *competition* and *mercantile viewpoints* play a great role in the development of information systems. A *functioning cooperation* would be more important for science.

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SECTION II

EPIDEMIOLOGICAL INFORMATION

David J. Matthews,
Chairperson

INTRODUCTION

In compiling this section of the symposium it was determined that the diverse nature of the subject, including natural overlap with the section on laboratory and clinical data, required that individual papers should not be discussed in isolation. Preferably they should supply the basic information to identify points of concern. The papers presented, including those on laboratory and clinical data, identify some systems being used in different countries. Discussion of these papers will follow Section III.

David J. Matthews,
Chairperson

INTERNATIONAL COLLECTION AND COMPILATION OF ANIMAL DISEASE INFORMATION

Heinz O. Königshöfer*

HISTORY

Interest in animal diseases is as old as man's association with his domestic animals, and since time immemorial there has been an exchange of information on this subject across tribal and national boundaries. The systematic and regular compilation of animal disease statistics, however, is a relatively recent development, which was introduced by national veterinary legislation in the various countries toward the end of the nineteenth and in the beginning of the twentieth centuries. These national statistics refer to a limited number of diseases which are notifiable under the veterinary legislation of the countries concerned. In addition, in the course of time, some countries began to produce statistics also for those animal diseases which are not strictly notifiable, but otherwise officially controlled.

The first scheme for the systematic collection and international dissemination of the various national animal disease statistics came into being with the creation of the International Office of Epizootics (OIE) in Paris in 1924. This scheme is still operating. It has contributed much to international veterinary cooperation and, within the limits determined by its very nature, it can hardly be supplanted by any other system.

In 1952/53, Sir Thomas Dalling, at that time coordinator of the Food and Agriculture Organization (FAO) Animal Health Group, began to elaborate plans for a new international animal disease reporting program of broader scope, compiled and presented in a way which would favor the international comparability of data and which would provide a global picture of the status of animal diseases and their development all over the world. The intention was that this scheme should be complementary to the OIE reports. It would be operated by FAO, with the cooperation of OIE, and would be jointly sponsored by FAO and OIE.

Exchanges of views with OIE on the subject began in July 1953 and finally, in a meeting held at OIE Headquarters in Paris, on October 17, 1955, Sir Thomas Dalling and Professor Ramon (at that time Director of OIE) agreed to present the plan as a joint proposal to the next General Assembly of

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OIE, in May 1956. The OIE General Assembly approved the plan, with some minor modifications, which referred mainly to the list of diseases and to nomenclature. The verbatim report of the session, however, clearly shows that there was much scepticism as to the feasibility of the program, and also some reluctance to accept the additional workload for the national veterinary services which were requested to reply at regular intervals to an unusually comprehensive questionnaire.[1]

FAO's original idea was that the "World Livestock Disease Report," as it was called, should become a quarterly publication in due course, but during an initial period there should be annual reports only. In fact, the report has always remained an annual publication, and this became a basic concept as soon as the first experience was gained.

The first questionnaire, to assemble the report for 1956, was distributed to the member countries of FAO and OIE on November 30, 1956. Replies were received, assembled in FAO, with difficulties much greater than had been anticipated, and the report for 1956 became available for distribution on January 15, 1958.[2] In addition to this unduly long delay, the presentation of the report was rather poor. In fact, it was generally considered to be a complete failure.

In view of this situation, Sir Thomas Dalling took a unique decision, which proved to be the correct one: Instead of reducing the information scheme to more modest proportions, he made it more ambitious, with the full support of Dr. K. V. L. Kesteven, at that time Chief of the FAO Animal Production Branch, who later became the first Director of the Animal Production and Health Division. In the questionnaire for 1957, information was requested not only on disease incidence, but also on control measures, and the reporting veterinary officers were asked to add narrative notes in all cases where they found that the codes were not sufficient to describe the situation. The narrative notes, of course, had to be translated into the three official languages of FAO, by the FAO Secretariat.

The report for 1957 was distributed in January 1959, for the first time under the name FAO/OIE *Animal Health Yearbook*.[3] The delay had been the same as in the preceding year, and the presentation was not much better. But in substance, the amount and quality of the information assembled were satisfactory, as a beginning.

Already in 1958, before the 1957 report was published, preparations were made for a more rational assembling of future reports, and for a more logical and systematic presentation. For easy reference, a multilingual alphabetic index was included at the end of the report. This standard format and working procedure was first introduced in the 1958 *Yearbook* and continued with only minor changes until 1970. Further, in order to reduce the workload of reporting officers in the national veterinary departments of cooperating countries, from 1958 onward replies to the questionnaire were requested only with regard to those diseases for which the information given in the preceding report was no longer valid.

The FAO/OIE *Animal Health Yearbook* for 1958 was thus prepared in a much shorter time, and was distributed to member countries in July 1959.[4] The timetable has been maintained since then: deadline for receiving reports, March 15 of the year following the year to which the report refers; assembling, translating and composition to be finished by May 31. The distribution of the printed document can thus take place during the first half of July (one month is needed for printing, binding, and dispatch arrangements).

From 1961 onward the World Health Organization (WHO) agreed to cosponsor the *Yearbook* jointly with FAO and OIE, and to collect information from those of its members which are not members of FAO.[5] In 1971, a decision was taken to reduce the format of the *Yearbook*, and several changes were introduced on that occasion, to which reference will be made below, in the context of scope and code symbols.[6]

CURRENT STATUS

Purposes and Scope

The purpose of the international collection, compilation, and dissemination of animal disease information through the *Animal Health Yearbook* is to serve as a tool in the prevention and control of animal diseases, in the widest sense: operational for the regulatory veterinary services, academic for research purposes, and as an aid to market analysis for the veterinary pharmaceutic industry. Further, the information scheme is intended to facilitate the expansion of international trade in livestock and livestock products under sanitary conditions, to facilitate rapid diagnosis and differential diagnosis where required in connection with the international movement of animals, and in general to serve any useful purpose for which worldwide data on animal diseases and their control may be required.

The geographic scope is worldwide, and as to the scope of diseases covered, the only basic limitation is the availability of data from official sources. This limitation, although purely pragmatic, is a real one. FAO, being a governmental international organization, can collect information from government sources only and, except for a few countries where close relations exist between veterinary administration and research organizations, the data which can be obtained from the regulatory veterinary services are mainly those which refer to notifiable and officially controlled diseases, including those which are of direct interest for differential diagnosis. The scope of diseases covered by the format of the *Yearbook* used from 1958 till 1970 was much broader than the present one, but experience has shown that for most of the diseases omitted since 1971, official information can be obtained from very few countries only.

The wide range of purposes and the broad scope of diseases covered must be explained from the historical background. The intention was to overcome

the limitations of traditional national disease reporting, which in many respects was too narrow for international purposes. It was obvious that the new system would also find its limits, but there was no reason to set these limits arbitrarily and *a priori*.

Specific Features

Specific features of the reporting system are i) the incidence code, ii) the control code, iii) the narrative notes, iv) the supplementary reports, and v) the appraisal of changes in the livestock disease position during the reporting year.

Before comment on each of these specific features, the presentation of the report as a whole will be summarized briefly. The diseases of mammals and birds are arranged in eight tables, designated by letters A to H. The names of diseases (at the top of each page) are listed in the order: English, French, Spanish, and the Latin technical term for the disease (printed in small capitals) or, alternatively, for the causal agent (printed in italics). Diseases of bees and fish appear on tables I and J, respectively. The set of tables A to H is repeated eight times, referring to different geographic groups of countries, and in each group the countries are listed in geographic order, so that neighboring countries are grouped together. On the first line on each page, below the names of the diseases, there are two digit code numbers (from 01 to 13) and Latin abbreviations, indicating the species of animal in which the disease or its absence is reported, in the column concerned.

The relative prevalence or absence of the disease, in the animal species and in the country concerned, is indicated by a code symbol (e.g. + or +++ or -), and in case of absence the year of the last incidence recorded is shown below the symbol (e.g. $\overline{1903}$ means last record 1903). The sign 0000 (instead of a year) means that the disease was never recorded in the country. Below the incidence symbol there is another symbol indicating the method of control, e.g. V means vaccination and S means slaughter. An asterisk (*) indicates that the disease is notifiable. Additional information is given in narrative notes, in English, French, and Spanish, on the page opposite each table.

The country reports are supplemented by more detailed reports on specific matters. Among these, the reports on vesicular diseases have been a regular feature in all issues of the *Yearbook*. In 1962 there was a comprehensive report on economic losses caused by animal diseases, and various other topics have been covered on different occasions. The last part of the *Yearbook* is a narrative report on changes in the livestock disease position, which is based on an analysis of the returns received, compared with previous returns.

Following are a few remarks on each of these specific features:

i) The incidence code:

There are several reasons for using a relative incidence or prevalence code in this international reporting system, instead of the absolute figures of reported outbreaks which are normally given in national reports. First of all, the term "outbreak" does not mean the same in all countries. It may mean an infected farm with one or two animals, but it may also mean an infected village or even an infected district with thousands of animals and so it would be misleading to compare and tabulate together the number of reported outbreaks in different countries, unless a definition of the term "outbreak" is given in each case. Secondly, the degree to which notification at the farm level can be enforced varies under different production and control systems. The veterinary administration may have circumstantial evidence, e.g. from findings at meat inspection, market inspection, or inspection of transports, showing that the total prevalence must be considerably higher than what the reported number of outbreaks might suggest, and in that case the indication "widespread" (+++) will certainly be more informative than the figure. Finally, for non-notifiable diseases, data in numeric terms are very seldom available—and the same disease may be notifiable in one country, but not notifiable in another country.

At present the following incidence symbols are used:

-	Not recorded; obviously not present
(-)	Not recorded; probably not present Year last occurrence: below symbol 0000: never
?	Suspected but not confirmed
(+)	Exceptional occurrence
+	Low sporadic incidence
++	Moderate incidence
+++	High incidence
...	No information available
+\	Disease much reduced, but still exists
+ø	Confined to certain regions
+ ⇐	Mostly in imported animals
+!	Disease only recently recognized in country
+∿	Seasonal occurrence
+··	Disease exists; distribution and incidence entirely unknown

Previously, a set of three digit code numbers was used. (Sir Thomas Dalling's original idea had been a series of letters from A to H.) The experience with the code numbers was not favorable. On many occasions they were found to be a source of error in reporting, and they were cumbersome for the reader of the *Yearbook*. The meaning of the new symbols can be grasped with one glance, and in many instances even without reference to the key.

ii) The control code:

The following abbreviations are used for the control code:

test	Systematic testing under official control scheme

Cn Control of non-vertebrate vectors
Cr Control of wildlife reservoirs
P Prohibition of imports from infected countries
Q Quarantine, movement control, and other precautions at frontier and inside the country
Qf Quarantine and other precautions at frontier
Qi Quarantine measures and movement control inside the country
S Slaughter policy
T Treatment (therapeutic and preventive)
Tp Preventive treatment
Tt Therapeutic treatment
V Vaccination
* Notifiable disease

Until 1970 three digit code numbers were used, and the experience with these was as bad as with the incidence code numbers. The control codes, of course, can only give an approximate idea of the actual control policy (e.g. S may be slaughter of diseased animals only, or slaughter of diseased and contacts, or depopulation of the affected area; V may mean regular mass vaccination or only vaccination of a few particularly valuable animals for their individual protection). This limitation is unavoidable because a more detailed differentiation would require a much larger number of symbols, which would make the report unreadable, without adding substantially to the informative value. On the other hand, experience has shown that in many instances a few additional remarks in the narrative notes are sufficient to complete the picture.

iii) The narrative notes:

In principle, there is no limitation as to the content of these narrative notes. The subjects covered include additional information on incidence, such as more precise definition of seasonal incidence, differences of distribution in various areas of the country, or in different sectors of the livestock industry; occurrence in species other than those listed in the tables, and history of incidence in previous years; economic significance; diagnostic procedures; additional information on control measures; plans for future action; financing of control; information on other diseases, related by etiology or symptoms to those listed in the tables, etc. The narrative notes add substantially to the amount of information contained in the report, and they make the system more flexible, which is necessary because very often it is difficult to press biological information into the rigid format of a preconceived table.

iv) The supplementary reports:

These reports permit expansion of information, in some instances even without putting additional workload directly upon the cooperating national veterinary services. Although in recent years the supplementary reports were limited to those on vesicular diseases, there is in principle much scope for future development. The only statutory limitation is that the supplementary report must originate from a source which formally or implicitly has been authorized by the governments to provide such information

(e.g. international reference laboratories, commissions, or formally established and recognized expert panels).

v) The appraisal of changes in the livestock disease position during the reporting year:

This section has been included in the *Yearbook* at the request of a great number of member countries. Differences between the situation revealed in the current report and that in the preceding report become automatically evident in the process of assembling and editing; however, it is always a problem to decide which changes in the report reflect real changes in the situation and which ones are due to more successful disease surveillance. Consequently, errors of interpretation may occur, and have in fact occurred.

Collection of Information

To collect the information, a questionnaire is distributed annually to the chief veterinary officers of all countries, and through official channels to the governments. The questionnaire has exactly the same format as the tables of the *Yearbook*. This facilitates assembling, and it also facilitates the work of the reporting veterinary officer, through easy comparison with the data given in the preceding issue of the *Yearbook*.

These, of course, are only the mechanics of data collection. The main problem is to enlist cooperation. This can be done to some extent by personal contacts. In the long run, however, the only possible way is to produce regularly a document which is useful for those from whom a regular supply of information is requested, and thus to convince the suppliers of information that the trouble they are taking is not in vain.

The nomenclature used in the *Yearbook* is purely pragmatic. Where different terms are in use for the same disease, the term is selected which is most likely to be generally understood in the correct way in all countries and which lends itself least to misinterpretation in substance. The choice of a disease name in the *Yearbook* does not imply any expression of an opinion on problems of taxonomy. For the international collection of information a "wrong" expression which is understood must be preferred to a correct one which is not understood by some of those who are requested to supply information.

There are certain basic problems of standard nomenclatures.[7] Most of them do not affect the *Yearbook*. They are of practical significance for more sophisticated computerized systems only (e.g. trichinosis, trichinellosis or trichiniosis; hog cholera or swine fever). Difficulties for the *Yearbook* reporting arise when the same word has different meanings in different countries, such as fowl pest (in British regulatory texts used as a common denomination for fowl plague and Newcastle disease; in some other countries used as a synonym for fowl plague), or if a term is almost regularly misinterpreted in countries of different languages (e.g., swine dysentery was misinterpreted in many countries as meaning an unspecific

severe enteritis). These difficulties can be overcome by various means, and they have largely been overcome, mainly by omitting the dubious terms completely, or substituting for them less conventional but internationally unequivocal terms.

The distinction between certain highly contagious diseases and closely related but less virulent infections is more a matter of substance than of nomenclature. Under present circumstances, it is unavoidable that the same disease is reported by one country as fowl plague, by another country as fowl influenza. The same applies to fowl cholera as distinct from other avian pasteurellosis, or hemorrhagic septicemia as distinct from other bovine pasteurellosis, and others.

Assembly, Analysis, and Dissemination of the *Yearbook* Report

The technical details of assembling the report and finally producing the printed document are probably not of general interest and will not be discussed here. It should be mentioned, however, that the process of assembling is accompanied by a thorough analysis of the returns received, with a view:

i) to insure that all facts communicated are duly reflected in the report, no matter whether they fit into the format or not;

ii) to monitor the suitability of the format and to make appropriate adjustments for future editions, as far as possible without disturbing the continuity of the reporting system, which is essential for comparison with subsequent years;

iii) to monitor the suitability of the nomenclature used;

iv) to investigate needs for adjustment, where necessary, to insure continued cooperation;

v) to identify matters which require correspondence with the supplier of information (for immediate action, if clarification is needed for the *Yearbook* in preparation; for attention after termination of the current issue, if concerning suggestions or queries);

vi) to identify changes in the reported disease situation, as compared with preceding reporting periods.

The FAO/WHO/OIE *Animal Health Yearbook* is distributed as a "priced publication," which means it is on sale through the FAO sales agents; a certain number are distributed free of charge to the member governments of FAO, WHO and OIE and, of course, directly to the chief veterinary officers who have contributed to the report.

FAO has the copyright. This, however, is no restrictive factor, since it is the policy of FAO to permit reproduction, upon request and under the

condition that acknowledgment is made of the source.

Linkage with Other Reporting Schemes

There is an implicit linkage of the *Yearbook* with the OIE reporting system which results from the FAO/OIE inter-agency agreement, and from the fact that OIE is one of the sponsoring organizations of the *Yearbook*.[8] There are, however, no detailed formal arrangements for linkage.

The quarterly reporting system of the Inter-African Bureau of Animal Health (IBAH, now Inter-African Bureau for Animal Resources, IBAR) was the first one in which the disease incidence was reported in terms of code signs (using letters). In 1960, arrangements were made to facilitate cooperation and exchange of data, and IBAH adopted, for that purpose, the code numbers which until 1970 were used in the *Yearbook*.[9] IBAR still uses these code numbers.

New regional quarterly animal disease reporting schemes are being developed in the Andean subregion of South America[10] and in Asia, the Far East, and Southwest Pacific[11] which will use the format of the FAO/WHO/OIE *Animal Health Yearbook* for reasons of global linkage, and in order to reduce the workload implied in international reporting.

In 1959 an arrangement was made with the Commonwealth Bureau of Animal Health, by which the Commonwealth Bureau supplied to FAO information on selected bibliographic information obtained in the course of compiling the *Index Veterinarius*.[12] Thanks to this arrangement it was possible to monitor systematically any apparent discrepancies between official reports and published literature, and to make the necessary inquiries for clarification. This has contributed much to the accuracy of the *Yearbook*, and it also gave the official veterinary services an opportunity to make the appropriate rectifying statements, when the unofficial publication was obviously erroneous. Unfortunately this cooperation had to be discontinued when the *Index Veterinarius* was computerized (because the cost would have become prohibitive).

DEVELOPMENT PROSPECTS

Future development prospects consist mainly in closer linkage with other international reporting systems and bibliographic data banks. The scope of diseases covered by the annual report will certainly require adjustment from time to time and in addition, if funds permit, supplementary reports might be considered on the status of such diseases as do not require annual reporting, but which should be reviewed every five or six years. It might also be possible to include, in the annual editions, some specific supplementary reports, similar to those on vesicular diseases, e.g. on the progress of the campaigns against African trypanosomiasis, or more general subjects such as economic analysis of losses caused by animal diseases.

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ANIMAL DISEASE SURVEILLANCE IN GREAT BRITAIN

Gareth Davies*

The last ten years have seen a steady increase in the demand for information on the prevalence, distribution, and cost of animal disease. The demand exists in most countries that have a significant livestock industry but the developing countries have tended to collect data on the prevalence of infectious disease while the developed countries, with relatively disease free animal populations, have placed more emphasis on the immediate identification of new or imported disease, and on herd health records that can be used as management aids in intensive husbandry systems. This paper briefly reviews the progress that Great Britain has made in this field and describes two animal disease data banks that are successfully contributing to the national surveillance program.

Animal Disease Surveillance in Great Britain is the title of a Ministry of Agriculture working group report[1] that was issued in 1976. It is in three parts: (a) the requirements for surveillance information, (b) a review of existing and potential sources of disease data, and (c) recommendations aimed at harnessing the data sources to a national surveillance program.

In reviewing information requirements the working group approached government departments, research organizations, universities, pharmaceutical firms, and other data "customers." They found that although each had its own particular set of needs, many were common to all the organizations and could be met by the following five facilities:

(1) a comprehensive body of simple disease data that is readily accessible;
(2) a capability for detailed assessments of particular disease situations;
(3) an early warning system for new events (new diseases, rapid changes in prevalence, disease losses in new systems of husbandry);
(4) facilities for tracing the course of outbreaks of infectious disease;
(5) systems that record details of disease events on certain farms over a long period of time (on-farm recording systems).

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When the working group turned its attention to the available sources of data it found that a great deal of information of value in disease surveillance was already being collected in the course of statutory, commercial, investigation, and research activities within the agricultural industry. These sources are listed in Table 1.

TABLE 1. Sources of Surveillance Data in Great Britain

Abattoirs
Poultry Packing Plants
Knacker Yards
Veterinary Practices
On-farm Records (Health and production data)
State Veterinary Service Intelligence
Veterinary Investigation Diagnosis Analysis (VIDA)
Zoonoses Order Records
Serum Banks
Zoological Records
Milk Marketing Board
Meat and Livestock Commission
Pharmaceutical Sales Indices

Some of these sources were already being exploited for surveillance purposes but in others, such as abattoir records, there was scope for considerable development.

The working group made two main recommendations. First it suggested that the existing sources of information on disease prevalence and distribution should be exploited to their full potential. It did not propose the setting up of any major new information collecting systems. Secondly, it felt that a major defect of existing surveillance was that data were collected but not disseminated and that many data customers, particularly those outside the Ministry of Agriculture, were not aware of the information available. It proposed the regular publication of collated surveillance data.

These recommendations have provided the framework for the subsequent development of animal disease surveillance in Great Britain. The Epidemiology Unit acts as a clearing house for surveillance data both by developing the various data sources and by producing the quarterly *Animal Disease*

Report and other publications. However, the most valuable sources of surveillance information are those that are under government control and it is in this area that recent developments in disease surveillance have been concentrated. They include two major data banks, VIDA II and the Zoonoses Order data bank.

VIDA II (VETERINARY INVESTIGATION DIAGNOSIS ANALYSIS) A DIAGNOSTIC LABORATORY DATA BANK

The thirty-three Veterinary Investigation Centres in England, Scotland, and Wales provide a national diagnostic and consulting service to veterinary surgeons. They carry out autopsies and laboratory examinations on material sent in for diagnosis and these are often supplemented by farm visits, long-term inquiries, and minor research projects. Some 150,000 specimens or batches of specimens are examined each year ranging from whole carcasses to blood and feces samples. These enable the laboratories to perform a valuable surveillance function and a number of new diseases and syndromes have been first identified by the Veterinary Investigation Centres.

Prior to 1967 there was no central record of the diagnoses made at these laboratories and the only available information was contained in an annual report that was partly statistical and partly anecdotal. In that year Veterinary Investigation Diagnosis Analysis (now known as VIDA I)[2] was adopted. Initially the records were kept on cards but the system was designed for eventual input to a computer file. VIDA I foundered for three main reasons. First, the information demanded of the diagnostic officer was too complex. Secondly, the disease classification system, a variant of SNVDO,[3] was somwehat cumbersome and ill-suited to the pressure of work in a busy diagnostic laboratory. Thirdly, the classification was not entirely mutually exclusive and a search of the central record did not with certainty identify all the relevant diagnoses. The system did, however, provide the government service with valuable experience in data bank operation, and in 1973 it was replaced by an entirely new system, VIDA II,[4] which operated as a trial in a limited number of Centres until it was extended to cover all thirty-three laboratories in January 1975.

The VIDA II record provides the following data for each submission of material:

(1) identity of the Veterinary Investigation Centre (V.I.C.);
(2) V.I.C. reference number;
(3) date of submission;
(4) geographical origin of the material by county;
(5) species of animal concerned;
(6) age of the animal;
(7) type and number of specimens received in one submission;
(8) fee charged;
(9) diagnoses made and whether they represent a new incident on the

farm or are related to a previously recorded incident.

All material submitted to a Centre is entered on the right hand side of a record sheet (Appendix I). The left hand side of the sheet acts as a computer punching document and each submission of material is coded in thirteen fields. See Table 2.

TABLE 2. Coding Fields for V.I.C. Record Sheet

Field 1	Centre Code	2 digits
Field 2	Class of Animal	1 letter
Field 3	Date (Month/Years)	4 digits
Field 4	County Code	2 digits
	Parish (Special Projects) Codes	3 digits
Field 5	Number of Specimens	2 digits
Field 6	Type of Specimen	2 digits
Field 7	Fee Charged	4 digits
Field 8	NIL Charge Code	1 digit/letter
Field 9	Submission Number	4 digits
Field 10	Age/Age Indicator	3 digits + 1 letter
Fields 11-13	Diagnoses (including indication if a "new" case)	4 digits

The coding is completed by clerical staff with the exception of the diagnostic codes. The veterinarian records his diagnoses on the right hand side of the document and this verbal description is coded either by himself or by an experienced clerk in fields 11-13. Some of the items coded are common to most data banks, but the species and age of animal, the type and number of specimens, and the diagnosis made have to take account of the diverse nature and the volume of V.I. Centre input.

The animal species are classified as cattle, cattle fetal material, sheep, pigs, birds, and miscellaneous, and the latter two categories are further subdivided (Appendices II and III).

The type of specimen is recorded as in Appendix IV. In recording the number of specimens, a distinction is made between samples, specimens, and submissions. If a cow is bled and various aliquots of the bleeding are used for different biochemical tests these are samples of one specimen. If blood samples from five cows are sent in they are recorded as five specimens making up a single submission. If blood and feces samples are

submitted from a single cow (e.g. for Johne's disease diagnosis) they are recorded as two submissions that are cross referenced to avoid duplication of diagnoses. The diagnoses (three are allowed) refer to the submission although the number of specimens is recorded. The diagnoses are not ranked.

The age of the animal has to take into account fetuses, day old chicks, and mature cattle; it can be recorded as days, months, or years in three numerical characters and one alphabetical indicator. An indication is given of whether the age is putative or estimated (Appendix V).

The unique feature of the VIDA II system is its list of diagnoses. Experience with VIDA I showed that any recording system that attempted to describe the lesions (as in the SNVDO system) was not only open to misinterpretation and variation between diagnostic officers but also went beyond the needs of its data customers. What is required for surveillance purposes is a list of conditions that are commonly accepted as "diagnoses." They may not be full descriptions of the syndrome identified; in some cases the diagnosis describes both the pathological change and the causative organism, e.g. Mastitis due to *E. coli;* in others it refers only to the isolation of the presumed causative organism, e.g. Rotavirus infection; and in yet others it refers to the lesions observed in an as yet imperfectly described syndrome, e.g. fatty liver and kidney syndrome in fowls.

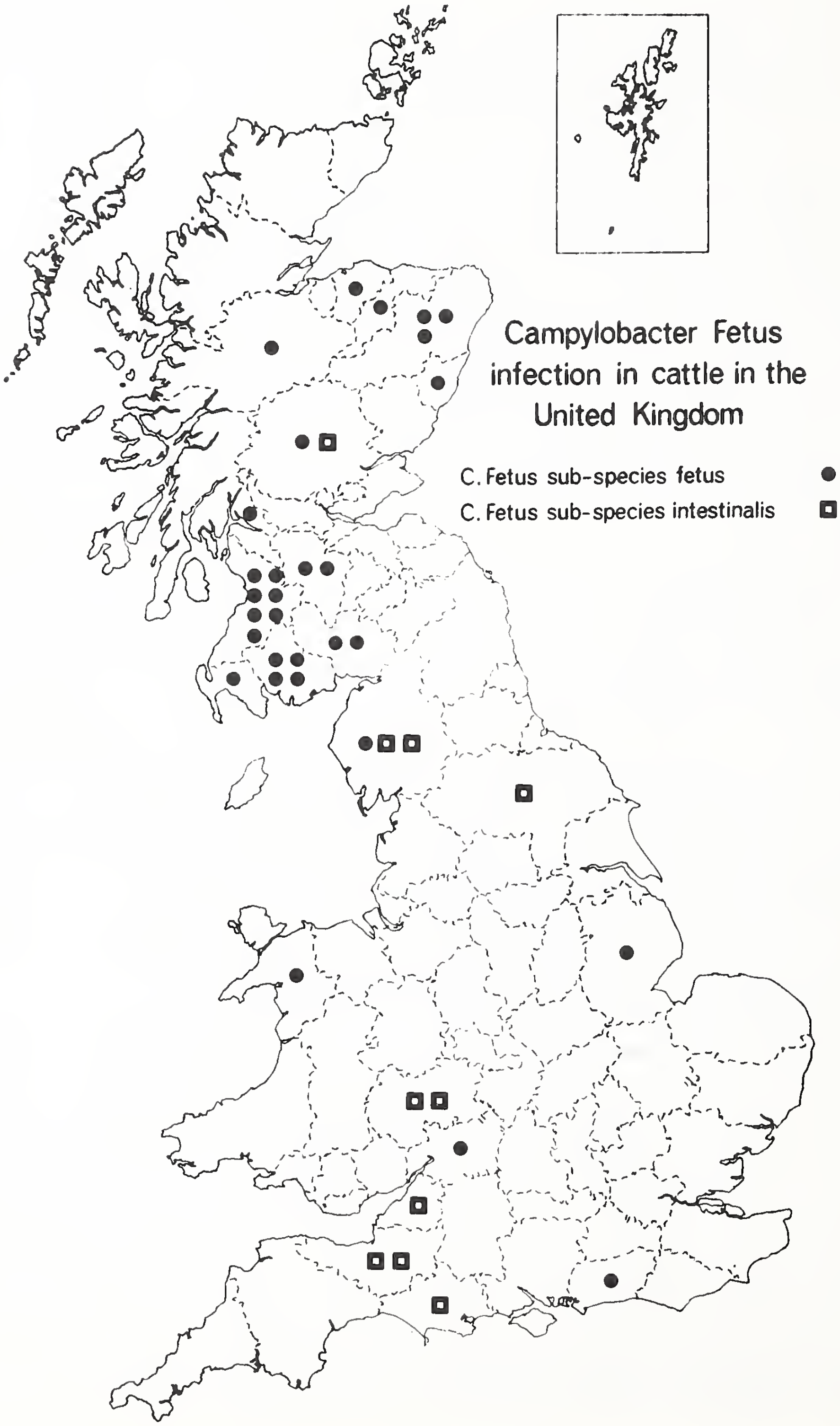
The VIDA II diagnostic list (a sample is shown in Appendix VI) extends to 399 diagnoses (cattle 101, pigs 72, sheep 96, birds 77, and miscellaneous 53) and it is in effect a written version of the verbal description commonly used by diagnostic officers and other pathologists. It has been remarkably effective.

The left hand side of each record sheet is sent to the Ministry of Agriculture computer center, a copy being held by the Veterinary Investigation Centre. Input to the ICL 1904S computer is by direct keying and the records are validated for omissions and for incompatabilities, e.g. a fish disease ascribed to a mammalian species.

The data bank output takes two main forms, an annual report[5] and a retrieval service. Both are handled by the Epidemiology Unit, Central Veterinary Laboratory, Weybridge. The annual report lists all the diagnoses made each month during the year and compares it with previous years (Appendix VII). The retrieval service exists for research workers and others who either want information on the distribution and prevalence of disease that goes beyond that in the annual report or who want to identify and investigate certain syndromes. An example of the former are maps showing the distribution of certain diseases (Figure 1), and of the latter the provision of the identify and location of all cases of white muscle disease in cattle. The identification of diagnoses on the record allows workers to extract the full case records from V.I. Centre manual files.

The VIDA II system has operated with considerable success since January 1975. There are few difficulties in the input of data and the percentage

FIGURE 1


Campylobacter Fetus infection in cattle in the United Kingdom
C. Fetus sub-species fetus
C. Fetus sub-species intestinalis

of invalid reports received by the computer center has fallen to below one percent. The diagnostic list is reviewed at intervals, partly by inviting comments from the V.I. Centres and partly by trawling the diagnostic category, "diagnosis not listed." No addition or other alteration is made until a steering group is satisfied that the new diagnosis represents a widely recognized and reasonably well defined entity.

It seems unlikely that any major alteration will be made in the system in the foreseeable future. However, there may be some redesign of the input forms and the records may be extended to include an indication of the "presenting problem," e.g. diarrhea or respiratory disease.

It is a common criticism that diagnostic laboratory records cannot be used for surveillance as they represent a biased sample of actual problems in the field. It can be seen from Table 3, however, that diagnostic records properly compiled provide a very valuable indication of disease trends.

TABLE 3. Analysis of the Causes of Abortion in Sheep in Great Britain

	Year		
Diagnosis Recorded	1975	1976	1977
Total Sheep Submissions	11,534	11,119	11,816
Fetopathy due to Brucella abortus	4	1	-
Fetopathy due to Campylobacter fetus	42	43	77
Fetopathy due to Corynebacterium pyogenes	5	10	3
Fetopathy due to Listeria monocytogenes	6	11	4
Fetopathy due to Salmonella abortus ovis	8	4	3
Fetopathy due to Salmonella dublin	4	-	10
Fetopathy due to Salmonella typhimurium	2	2	-
Fetopathy due to other Salmonella serotypes	4	8	13
Fetopathy due to Chlamydia	160	237	188
Fetopathy due to fungi of any species	3	5	4
Fetopathy due to Toxoplasma Spp	158	184	211
Fetopathy: diagnosis not on VIDA list	118	69	70
Fetopathy: diagnosis not reached	813	816	766
Total fetopathies	1,427	1,390	1,345

The VIDA II annual report is widely used by the veterinary profession in Great Britain and over eighty retrieval inquiries are processed each year by the Epidemiology unit. The system as it stands has been proven to fulfill the requirements of the veterinary service in Great Britain.

THE ZOONOSES ORDER DATA BANK (ANIMAL SALMONELLOSIS)

Salmonella infections in food animals are recognized as a problem not only in veterinary medicine, but in the food industry and in the control of public health. Infection originating in animal feedstuffs may spread within large intensive animal rearing units, and when the animals or birds are slaughtered the carcasses and offals can serve as foci of contamination to other meat and meat products in the abattoir plant. There are losses on the farm and in the abattoir and the contaminated food is responsible for food poisoning incidents in the human population. Control of these infections requires cooperation between the veterinarians operating on the farm and in the abattoir, and the public health officials who are responsible for food hygiene and human health. Control and cooperation cannot be engendered without information on the source and identity of infections. The collection and provision of such data was one of the main objectives of the Zoonoses Order (1975).[6] The Order requires notification of the isolation of salmonella from food animals or animal products and the report must include the identity of the organism, the species of animal involved and its location, and the date of isolation. This information is passed to a government nominated officer who is a veterinarian, generally in one of the Veterinary Investigation Centres, and he uses the information to initiate local inquiries, sometimes in collaboration with the medical authorities. He also forwards the data to the Epidemiology Unit at Weybridge where it is added to the Zoonoses Order data bank.

Prior to the inception of the order, records of salmonella infections were collected by laboratories,[7] but these related solely to isolations and did not reflect the location and extent of infection on the farm. The Zoonoses Order data system seeks to overcome these deficiencies by introducing the concept of an "incident" which is used by the nominated officer in reporting infection to the Epidemiology Unit at Weybridge. An "incident" broadly means salmonella infection of a particular serotype identified at premises where the infection has not been recorded for at least four weeks previous.

The Zoonoses Order data bank is therefore based on incidents. Each incident is described by the statutory data (location, species of animal infected, serotype and phage type, and date of isolation). In addition, the nominated officer makes inquiries and adds information on the extent of infection or disease on the farm, and the risk to human beings through sewerage, or farm sales of food products, etc. The information is transmitted to the data bank on a standard form (Appendix VIII).

The records in the data bank are compiled manually but steps are underway

to computerize the operation and while this is being done further kinds of data are being added. There has been a recent outbreak of chloramphenicol-resistant *S. typhimurium* which has considerable implication for the treatment of any consequent human infection and the data are now being extended to include antibiotic sensitivity patterns. At the moment there is no clear distinction between incidents that describe frank disease and those representing chance isolations of salmonellae in healthy stock; this distorts the record and steps are being taken to correct this bias which particularly affects the poultry industry. The reports are also being altered to include clear statements on the risk to human beings so that information can be provided to medical workers as quickly and clearly as possible.

The data bank is used in two ways. It provides information for immediate control use and it serves as a long term record of trends in infection that educates and informs all those who are concerned with animal salmonellosis and food borne infections. Nominated officers reporting an unusual serotype inquire of other incidents involving that serotype so that they can trace the source of infection. Serotypes identified in imported animals in quarantine are checked against the serotypes currently circulating in the indigenous animal population. The incident reports from throughout the country are collated at intervals and three monthly and annual summaries[8] are produced as a service to veterinarians and public health workers (a sample is shown in Appendix IX). The movement of infection in the animal population is traced (Figure 2).

The movement of infection into the human population can also be traced, but this is far more difficult. The Epidemiology Unit's medical equivalent (The Communicable Disease Surveillance Centre, CDSC) is building up its surveillance facilities in this field and eventually we hope to have a system by which they are immediately aware of the location and significance of all outbreaks of salmonellosis in food animals.

One major problem in operating a salmonella surveillance system is the time taken to serotype and phage type the salmonella isolates. These procedures may take several weeks and it is for this reason that the Unit now produced quarterly rather than monthly reports.

The British experience of animal disease data banks is that they are successful if they are based on "captive" sources of information, i.e. where the discipline of recording can be maintained. But it must be realized that data banks do not run themselves; they need constant attention, and the operation of a series of large data banks such as VIDA II and the Zoonoses Order data bank requires a veterinarian and two or three scientific and clerical support staff, quite apart from staff in the computer facility.

The initial two to three years of a data bank's existence is a "pump-priming" period during which records are accumulated but not used. If the bank can survive this period it can then be used to provide an indication of trends in disease prevalence and the accumulated data will be substantial enough to be of value for many types of scientific inquiry.

FIGURE 2

Premises on which Chloramphenicol-resistant Salmonella typhimurium have been isolated from calves, and routes of spread in Great Britain 1st January 1976 to 31st March 1978

Thereafter, if the collated data are disseminated properly, the staff providing the original information will see some purpose to their labor and the standard of recording can be maintained.

REFERENCES

1. *Animal Disease Surveillance in Great Britain, 1976,* available from the Epidemiology Unit of the Central Veterinary Laboratory, New Haw, Weybridge, Surrey, U.K.

2. M. E. Hugh-Jones, D. W. Ivory, R. M. Loosemore, and J. Gibbens, "Veterinary Investigation Diagnosis Analysis," *Veterinary Record* 87 (1969): 275-276.

3. U.S. Department of Health, Education and Welfare, Public Health Service, National Cancer Institute, Epidemiology Section, *Standard Nomenclature of Veterinary Diseases and Operations* (Bethesda, Md., 1966).

4. S. A. Hall and P. S. Dawson, publication in press.

5. *Veterinary Investigation Diagnosis Analysis II 1977,* available from the Epidemiology Unit, Central Veterinary Laboratory, Weybridge, Surrey, U.K.

6. *The Zoonoses Order 1975,* Statutory Instruments No. 1030 (London: HMSO, 1975).

7. W. J. Sojka, C. Wray, and Jean Shreeve, "Incidence of Salmonella Infections in Animals in England and Wales, 1968-1975," *J. Hyg. Camb.* 78 (1977): 43.

8. *Animal Salmonellosis, 1977 Annual Summary,* available from the Epidemiology Unit, Central Veterinary Laboratory, Weybridge, Surrey, U.K.

APPENDIX I

PART A — for retention at V I Centre

FORM TYPE	CENTRE CODE	CLASS	DATE	MONTH	YEAR
	1				

County	Parish	NUMBER OF SPECIMENS	Type	Fee Charged £ p.	FEE CHARGE CODE	Submission No.
4		5	6	7	8	9

Age	Ind.	Diagnosis 1	YES=1 NO=2	Diagnosis 2	YES=1 NO=2	Diagnosis 3	YES=1 NO=2
10		11		12		13	

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

Repeat Punch Form Type and Fields 1, 2 & 3 above

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

Repeat Punch Form Type and Fields 1, 2 & 3 above

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

Repeat Punch Form Type and Fields 1, 2 & 3 above

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

Repeat Punch Form Type and Fields 1, 2 & 3 above

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

4 | 5 | 6 | 7 | 8 | 9

10 | 11 | 12 | 13

VIDA 25 (Amended 8/74)

No. of Submissions on this form :..............

FOR LABORATORY USE ONLY

Class ....

Cross Ref	Submitted by	Owner	Specimen Description	Diagnoses	Report Date Pre	Report Date Final

4545 57 8619 [illegible]

APPENDIX II

FIELD 6 CODE TABLE FOR MISCELLANEOUS only — TYPE OF SPECIMEN CODE NUMBER

See other Tables for other Classes

For this Class the first digit of FIELD 6 indicates SPECIES and the second digit indicates TYPE OF SPECIMEN.

List for first digit code		List for second digit code	
HORSES/MULES/DONKEYS	0		
GOATS	1	CARCASES	1
GUINEA PIGS	2	VISCERA and VISCERAL SWABS	2
RATS/MICE	3	FOETUSES, FOETAL VISCERA, MEMBRANES and LOCHIA	3
RABBITS	4	BLOOD	4
FISH	5	MILK	5
DOGS	6	FAECES	6
CATS	7	RECTAL SWABS	7
ANY OTHER ANIMAL	8	ANY OTHER SPECIMEN	8
VEGETABLE/MINERAL MATERIAL	9	VEGETABLE/MINERAL MATERIAL	9

APPENDIX III

FIELD 6 CODE TABLE FOR BIRDS only

See other Tables for other Classes

TYPE OF SPECIMEN CODE NUMBER

For this Class the first digit of FIELD 6 indicates SPECIES and the second digit indicates TYPE OF SPECIMEN.

List for first digit of code		List for second digit of code	
FOWLS BREED UNKNOWN	0		
FOWLS BROILER BREED	1	CARCASES	1
FOWLS LAYER BREED	2	VISCERA AND VISCERAL SWABS	2
TABLE FOWLS OTHER THAN BROILERS	3	EGGS AND HATCHERY DEBRIS	3
PSITTACINES	4	BLOOD, serological - Newcastle disease	4
GAME BIRDS	5	BLOOD, serological - mycoplasmosis	5
DUCKS	6	BLOOD, other tests	6
GEESE	7	FAECES/LITTER containing faeces	7
TURKEYS	8	RECTAL/CLOACAL SWABS	8
ANY OTHER SPECIES OF BIRD	9	ANY OTHER SPECIMEN	9

(WEF 0175)

APPENDIX IV

FIELD 6 CODE TABLE FOR CATTLE, CATTLE FOETAL, SHEEP, PIGS

See other Tables for BIRDS and MISCELLANEOUS

	Type of Specimen Code Number
CARCASES	10
VISCERA and VISCERAL SWABS	20
FOETUSES, FOETAL VISCERA, MEMBRANES and LOCHIA	30
When a MILK specimen is submitted together with any of these FOETAL specimens, the collection is coded	31
NB Any entries of Type 30 and 31 for cattle *must* be entered in CLASS F *only*.	
VAGINAL MUCUS and VAGINAL SWABS non parturient	41
SEMEN and PREPUTIAL WASHINGS	42
BLOOD serological - Johne's disease	52
BLOOD serological - other than Johne's disease or brucellosis	53
BLOOD biochemical	54
BLOOD haematological	55
BLOOD other tests	56
MILK brucellosis MRT	61
MILK brucellosis cultural	62
MILK cultural other than brucellosis	63
MILK other tests	64
FAECES	70
RECTAL SWABS	71
ANY OTHER SPECIMEN	80

NOTE THAT NONE OF THESE CODES APPLIES TO CLASSES B AND M

(WEF 0175)

APPENDIX V

FIELD 10 CODE TABLE	AGE CODE LETTER (INDICATOR BOX)
If the age is KNOWN enter the appropriate numerals in the first three boxes and a code letter in the Indicator Box selected from this PUTATIVE AGE List.	
DAYS	D
WEEKS	W
MONTHS	M
YEARS	Y
If the age is NOT KNOWN an estimate of it should be made and entered as above except that the Indicator Box code letter is selected from this ESTIMATED AGE LIST.	
DAYS	A
WEEKS	K
MONTHS	N
YEARS	R
This system applies equally to FOETUSES except that in the case of a full term STILLBORN foetus enter in the Indicator Box code letter	S
If it is impossible to estimate the age, enter in the Indicator Box code letter	X
If it is INAPPROPRIATE to consider an age in relation to the specimen, enter in the Indicator Box code letter	P

APPENDIX VI

FIELDS 11, 12, 13 LISTED DIAGNOSES FOR PIGS

GROUP 1 SYSTEMIC DISEASES AND THOSE NOT READILY CLASSIFIED ORGANICALLY

087 CONGENITAL TREMBLING
060 HERED/DEVELOP ANOMS NOS
* 090 NAVEL BLEEDING

* 544 TRAUMA

515 ANAEMIA - IRON DEFICIENCY
545 MALNUTRITION NOS - *inadequate and/or unsuitable diet*

113 CL OEDEMATIENS DIS
117 CL WELCHII C DIS
110 CLOST DIS NOS
122 COLIBACILLOSIS OEDEMA DIS
120 COLIBACILLOSIS NOS - *for enteric colibacillosis see Group 2*
123 COLISEPTICAEMIA
133 ERYSIPELAS - *see also foetopathy dt Erysipelothrix*
139 LEPTOSPIROSIS
140 LISTERIOSIS - *see also foetopathy dt Listeria*
152 PASTEURELLOSIS - *to include pneumonia dt Pasteurella*
161 SALMONELLOSIS DT SALM C-S
160 SALMONELLOSIS DT SALM NOS
165 SALMONELLOSIS DT SALM T-M
134 SPH NECROPHORUS INF
171 STREPTOCOCCAL INF NOS - *see also Groups 6 and 9*
142 TUBERCULOSIS

720 NEOPLASM NOS - *see Group 8 for lymphosarcoma*

421 POISONING DT ARSANILIC ACID
410 POISONING DT CHEMICAL NOS
440 POISONING DT PLANT NOS
420 POISONING DT SALT - *water deprivation*

GROUP 2 DISEASES OF THE DIGESTIVE SYSTEM

\- CLOSTRIDIAL ENTERITIS - *see clostridial diseases Group 1*
121 COLIBACILLOSIS ENTERIC
234 EPIDEMIC DIARRHOEA
662 GASTRIC ULCERATION

APPENDIX VII

VIDA TABLE 3 PIGS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total 1977	Total 1976	Total 1975
GROUP 1 Systemic diseases and those not readily classified organically															
060 Hereditary and developmental anomalies	5	5	2	-	3	3	4	-	2	1	-	1	26	35	23
087 Congenital trembling	-	2	1	2	2	-	6	-	1	1	2	2	19	13	11
* *090* Navel bleeding	1	1	-	1	-	2	-	1	-	1	-	-	7	0	0
* *544* Trauma	5	7	9	11	3	3	2	9	2	3	7	8	69	0	0
515 Iron deficiency anemia	4	3	4	2	5	3	3	2	3	1	3	1	34	27	31
545 Malnutrition not otherwise specified	16	7	12	6	4	6	3	2	6	8	6	7	83	120	115
113 *Clostridium oedematiens* disease	2	1	2	3	6	4	4	2	3	3	2	3	35	31	42
117 *Clostridium welchii type C* disease	3	3	-	2	2	4	4	-	3	4	1	1	27	18	30
110 Clostridial disease not otherwise specified	3	1	-	-	4	2	1	2	1	-	1	2	17	15	11
123 Colisepticaemia	15	20	12	15	10	13	15	10	15	10	10	10	155	178	166
122 Colibacillosis – oedema disease	9	11	12	15	16	18	9	6	14	11	9	5	135	119	115
120 Colibacillosis not otherwise specified (see below for enteric colibacillosis)	18	15	19	22	24	10	14	13	16	25	21	12	209	266	240
133 Erysipelas (other than foetopathy)	2	1	1	-	2	-	7	2	1	1	4	2	23	49	45
139 Leptospirosis	1	-	-	1	-	-	-	1	-	-	-	-	3	4	3
140 Listeriosis (other than foetopathy)	-	-	-	-	-	-	-	-	-	-	1	-	1	2	1
152 Pasteurellosis (to include pneumonia due to *pasteurella spp*)	12	22	11	9	13	7	7	12	17	7	14	8	139	135	129
161 Salmonellosis due to *Salmonella cholerae-suis*	4	1	1	2	4	2	-	2	-	-	1	3	20	13	10
165 Salmonellosis due to *Salmonella typhimurium*	1	3	3	3	1	-	1	-	1	-	1	-	14	23	18
160 Salmonellosis due to other serotypes	7	10	4	7	5	1	5	5	4	8	3	5	64	61	37
134 *Sphaerophorus necrophorus* disease	1	2	1	-	1	-	-	-	-	-	-	-	5	7	3
171 Streptococcal disease (other than foetopathy and meningitis)	24	11	12	11	10	7	5	12	14	8	11	5	130	131	117
142 Tuberculosis	2	7	6	2	-	2	2	6	5	2	3	3	40	41	18
720 Neoplasms – not specified – any site	1	-	-	-	-	1	-	1	-	-	1	-	4	5	4
421 Poisoning due to arsanilic acid	-	-	-	-	-	-	1	-	-	-	-	-	1	4	9
420 Poisoning due to salt (to include water deprivation)	7	5	4	5	5	-	8	4	3	2	8	2	53	41	45
410 Poisoning due to chemical not specified	3	1	1	-	1	1	-	2	-	-	-	1	10	16	15
440 Poisoning due to plant not specified	-	-	-	-	1	-	-	-	-	-	-	-	1	1	2

APPENDIX VIII

Ministry of Agriculture, Fisheries and Food
Department of Agriculture and Fisheries for Scotland

SALMONELLA ISOLATION REPORT

TO BE COMPLETED BY NOMINATED OFFICER

C.P.H. No.

Nominated Officer	Month	Year	Serial No.

Last incident at that premises

Related incidents at other premises

Is this a statutory report? (YES = 1, NO = 2)

FOR OFFICE USE ONLY

1. Address where animals are kept ....

   District .... County/Region ....

2. Owner/Person in charge and address if different from above ....

   District .... County/Region ....

   Telephone No. ....

3. Isolating Laboratory ....

   Lab. Ref. No. (1) .... (2) .... (3) ....

4. Typing Laboratory ....

   Lab. Ref. No. ....

5. Nature of sample ....

6. Date of sample ..... / ..... / .....

7. Identity of organism(s) isolated

	Group	Serotype	Phage type
(1)			
(2)			
(3)			

8. Antibiotic sensitivity pattern (Complete as R (resistant) or S (sensitive))

Lab. Ref. No.	S3.50	SXT 25	C10	S10	TE10	N10	PN10	FR15		

9. Species and age of animal/bird ....

10. Type of herd or flock ....

11. Is there any evidence of clinical Salmonellosis? Please write Yes, No or Don't Know ....
    If 'YES', describe (including numbers dead or affected/total number in group)
    ....
    ....
    ....

12. Is there any evidence of human infection? Please write Yes, No or Don't Know ....
    If 'YES', describe ....
    ....

13. Does the owner/person in charge supply animal products direct to the public? Please write Yes, No or Don't Know ....
    If 'YES', describe ....
    ....

ZO 2(S)

P.T.O.

APPENDIX IX

Table 3: Incidents of salmonellosis reported in statutory species in Scotland, by host species and serotype.

Serotype	Cattle			Sheep	Pigs	Birds	Totals 1977	Totals 1976
	Adult	Calf	Foetus					
agona						9	9	9
anatum		1			2		3	6
arizonae				2			2	3
bovis morbificans	1	2					3	3
braenderup				1			1	-
bredeney						1	1	1
coeln							-	1
derby						1	1	1
dublin	21	17	5				43	78
enteritidis	1	2				1	4	2
hadar							-	1
havana		1					1	-
heidelberg	2	2		1	2	1	8	7
infantis	2					16	18	6
johanesburg				1			1	-
london		1			1		2	1
menston							-	2
montevideo	1	3		4			8	4
newington					1		1	-
newport							-	1
ohio						1	1	-
oranienburg							-	6
panama						1	1	5
paratyphi B							-	1
rissen							-	1
senftenberg						7	7	5
shubra						1	1	-
simsbury					1		1	-
st paul	1						1	-
tennessee							-	2
typhimurium	32	34		4	1	11	82	139
virchow							-	2
worthington				1		14	15	4
Group B	1						1	16
Group C							-	2
Group C1							-	2
Group D							-	5
Ungrouped		1					1	5
Totals, 1977	62	64	5	14	8	64	217	-
Totals, 1976	65	160	6	11	16	63	-	321

No incidents of salmonellosis were reported in rabbits or goats in Scotland in 1977.

PURPOSES AND OBJECTIVES OF WILDLIFE DISEASE INVESTIGATIONS IN THE SOUTHEASTERN UNITED STATES

Frank A. Hayes*

At the turn of this century, white-tailed deer (*Odocoileus virginianus*) had been virtually extirpated from the southeastern United States.[1] The demise of this early food staple resulted from unrestricted market hunting with total disregard for the fundamental principles of wildlife management. Today more white-tailed deer abound throughout this region than at the time of the first settlers. The return of this renewable natural resource was a consequence of a more conservation-oriented populace and changes in land use.

Concerted efforts toward deer restoration commenced shortly before World War I and continued in a rather haphazard fashion until October 1929. During the depression years that ensued, people of the southern United States were confronted with a concern of much greater magnitude than wildlife conservation. The few deer herds that had been reestablished afforded a source of food for substantial segments of a protein starved people. Early deer restoration programs were essentially abated until the late 1930's.

Concomitant with emergence from recession, interest in wildlife conservation regained prominence. Public concern was reflected through passage of the Pittman and Robertson Act of 1937, which is a sportsmen-sponsored, self-imposed tax bill, with all revenues designated for restoration and management of wildlife. This represented a significant landmark for development of white-tailed deer resources of the Southeast. Game and fish departments also began acquiring stature as official governmental agencies and they represented the actual foundation from which scientific management of wildlife would be realized.

World War II temporarily halted deer restoration. A precedent had been established, however, and after cessation of hostilities, efforts were intensified for development of deer restoration programs throughout the southeastern region. By the late 1940's, the success of this undertaking reflected a feat of which many people were duly proud.

The first disease threat to this new resource came in the summer of 1949

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when in late August alarming numbers of dead deer were found along streams and rivers of northern Georgia, western North Carolina, and eastern Tennessee.[2] Deer mortality spread rapidly into several other southeastern states, with ninety percent losses estimated on the Black Warrior Game Management Area of Alabama. The cause of death was not determined.

A few years passed without further incidents, and game and fish agencies throughout the region continued extensive trapping programs with deer being relocated from Michigan, Wisconsin, Texas, etc. Increased protection paralleled restocking, and sighting of these animals became commonplace. The public in general developed a high degree of pride in this new wildlife resource.

Then it happened again—in essentially the identical localities and at the same time of year. KILLER-X struck for the second time in 1954, and for a second time means were not available for a diagnosis to be made. Sportsmen and the public in general found the situation untenable, and grave concern was expressed for the future well-being of this highly prized outdoor recreational resource.

A recapitulation of this killing disease followed in the wake of the 1954 epizootic, when in 1955 "deer plague" hit with even greater intensity, expanding through much of the Appalachians and extending into the Ozarks. Thousands of deer were lost, but yet an organization was not in readiness for coping with this type of emergency in the Southeast. For the third time within a decade, KILLER-X had come and gone without identification.

The consensus was that the entire white-tailed deer resource was in grave jeopardy and could not withstand further assault by this mysterious disease entity. A pertinent question was proposed: "How can we ever hope to stop it when we do not even know what it is?" Sportsmen's groups, conservationists, and the general public demanded action, and their representatives responded accordingly.

After a series of planning sessions, the Southeastern Association of Fish and Wildlife Agencies conceived an idea for coping with future crises of this type. It was recognized that an organization with essential expertise and capabilities would be too costly for any one state game and fish agency to initiate and maintain. It was also realized that the problem in question was regional and not confined within state boundaries.

A joint-state approach therefore was developed for creating an organization that would be maintained to afford diagnostic services to state fish and wildlife agencies of the southeastern region. The program would be financed through annual pro rata funding and located in accordance with recommendations made by a Site Selection Committee appointed by the Southeastern Association of Fish and Wildlife Agencies. The University of Georgia's College of Veterinary Medicine was chosen as headquarters for what was designated as the Southeastern Cooperative Deer Disease Study (SCDDS).

The early concept of SCDDS was that of an organization primarily designed

to wait for the recurrence of so-called KILLER-X. It was soon recognized, however, that many other problems involving white-tailed deer were looming just beyond the horizon.

Brucellosis, for example, was moving to the forefront as a potential clash of interest between this developing big game animal resource and the cattle industry.[3] At that time, the Animal Health Division's (ARS, USDA) National Brucellosis Eradication Program was in full swing, and many cattlemen were rightfully inquiring about the status of white-tailed deer as reservoirs of this cattle disease. Clarification of this question represented one of the earliest surveillance endeavors of SCDDS, whereby white-tailed deer were essentially exonerated as significant carriers of brucellosis. Shortly afterward, similar studies were initiated on vesicular stomatitis, leptospirosis, anthrax, parasitism, etc.

During the early years of SCDDS, sponsoring state fish and wildlife agencies began referring disease problems involving game animal species other than white-tailed deer. The SCDDS, however, had been established for working with deer only; studies involving other wild animals were in violation of contract. This technicality was readily rectified when, in 1961, the name of the SCDDS was officially changed to the Southeastern Cooperative Wildlife Disease Study (SCWDS). Obligations of the SCWDS consequently were expanded to afford diagnostic services involving all wildlife species.

During the formative years of SCWDS, the relative dearth of information on diseases of wild animals became increasingly apparent.[4] The Southeastern Association of Fish and Wildlife Agencies readily recognized the mounting need for basic research in this new area of expanding public concern. Through the interest and efforts of the Association, supported by many esteemed members of the Congress of the United States, in 1963 provisions were made for annual funding to sponsor wildlife disease research with studies conducted by SCWDS in accordance with priorities designated by the Association. Funds were administered and research coordinated through the Fish and Wildlife Service of the U.S. Department of the Interior.

A Steering Committee was appointed that consisted of representatives from thirteen participating state fish and wildlife agencies, the U.S. Fish and Wildlife Service, the Wildlife Management Institute, and the University of Georgia. The SCWDS thereafter became directly responsible to this Committee, through which programs are planned and expedited in accordance with expressed needs of the various states.

Through this state-federal, mission-oriented program, objectives of SCWDS were fourfold: (1) to provide a joint-state diagnostic service for determining the cause(s) of morbidity and mortality of wildlife throughout the southeastern region; (2) to provide continuity of purpose for basic research on the effects exerted by disease and parasitism upon wildlife populations; (3) to define the disease interrelationships that exist between wildlife and domestic livestock; and (4) to investigate the carrier status of wildlife for pertinent communicable diseases transmissible to man.

Significant means thus were provided for obtaining vital information relative to increasing association between wildlife, domestic animals, and humans. Concomitant with the collective efforts of southeastern state fish and wildlife agencies, many individuals and institutions throughout the country became interested and actively engaged in research and surveillance directed toward fathoming the multitude of mysteries that shroud wildlife diseases.

Although within the last two decades tremendous progress has been made in this field, the surface has only been scratched. In considering the logistics through which valid information is obtained on the many interrelationships involving diseases of wildlife and their association with the environment, there are times when the complexity of problems seems insurmountable. The approach for diagnosing and investigating diseases of wildlife differs considerably from that of classical veterinary or human medicine, and the intents and purposes of study often are diametrically opposed to what some individuals and organizations regard as sound medical practice.

In contrast to the aforementioned medical sciences, the individual animal is not of consequence beyond affording information relative to the overall health of a wildlife population. Treatment seldom is considered, nor does diagnosis constitute the final objective. Within bounds of reason, when adequate numbers of suitable specimens are available, diagnosis is relatively simple. In the event of catastrophic die-offs of wildlife, determination of the immediate cause usually is not a major problem. In the light of experience gained over the past two decades, if a good case history is available, sixty percent of the indigenous diseases of game birds and mammals of the Southeast probably can be diagnosed by telephone.

The real challenge is not that of identifying a specific pathogen or disease process but determining why a specific wildlife species has become affected. What environmental factors or clash of circumstances made this particular species vulnerable at this time and place? What are the ramifications of the disease entity in progress? Will it inflict substantial mortality in the involved species? How far and to what other species will it spread? Does it constitute a problem for domestic livestock or human health? Are there measures that can be implemented to prevent spread or recurrence? These and many other questions must be anticipated before a field investigation is initiated.

Upon receipt of a call from a state fish and wildlife agency, SCWDS first appraises the population density of the animals affected. We are then concerned with association of diseased animals and other fauna in the area. The physiographic province within the region is equally important, with consideration given to season of the year, soil types, drainage systems, recent weather conditions, timber harvests, agricultural crops, past experience in similar areas, etc. With these factors in mind, augmented by case histories obtained via telephone or other communications, we engage in an initial process of elimination based upon what we currently consider the thirteen fundamental causes of morbidity or mortality within a wildlife population.[5] These are itemized as follows: Anomalies, Stress, Trauma, Suffocation, Neoplasia, Toxicosis, Malnutrition, Viruses, Rickettsiae,

Bacteria, Mycosis, Parasites, and Senility.

While a field team is en route to the area, it is routine procedure to critique these potentialities, thus narrowing probabilities from thirteen to three or four most likely disease conditions. Although this is rather elementary, we find that it minimizes lost motion upon arrival at destination. A synopsis of salient features of these mortality factors is presented as follows.

Anomalies: Anomalies are rare in wild animals and exert little effect upon populations. Animals of this kind succumb to the rigors of the environment. History of the area may reveal similarly affected animals.

Stress: Varying degrees of mortality indirectly associate with different forms of stress. Study of an area frequently will reveal the source(s) of stress. Stress is considered as a specific response to nonspecific stimuli, but population pressures alone have not been associated with wildlife morbidity or mortality in the Southeast.

Trauma: This frequent cause of mortality usually is manifested by discovery of occasional carcasses over a large area, but sometimes trauma cases may be concentrated to give an initial impression of an infectious disease or toxicosis. Study of the immediate vicinity frequently suggests sources of trauma. Astute necropsy observations are necessary to determine obscure traumatic lesions.

Suffocation: Careful necropsy should reveal the nature of involvement, which usually is drowning, collapsed trachea, or verminous pneumonia. Under certain circumstances verminous pneumonia inflicts unthriftiness and substantial morbidity and mortality among numerous wildlife species.

Neoplasia: Meaningful mortality of wildlife is not attributed to neoplasms but many tumors have been reported. Skin fibromas of viral origin are the most prevalent tumor of white-tailed deer. One or two affected animals can precipitate much public concern, but from a practical point of view fibromas are of academic interest only.

Toxicosis: Toxicities can inflict heavy mortality and give rise to considerable public concern. Poisoning often is difficult to diagnose and must be approached with extreme caution. Poisoning from ingestion of lead shot is considered one of the major mortality factors in migratory waterfowl.

Malnutrition: Significant mortality of wildlife in the Southeast is seldom due to starvation alone, but malnutrition predisposes animals to other mortality factors. A direct relationship appears to exist between nutrition and the degree and intensity of parasitism. Malnutrition causes some wild animals to consume excessive amounts of toxic substances.

Viruses: Practically all birds and mammals are susceptible to one or more viral diseases which under certain circumstances inflict heavy mortality. Many indigenous viral diseases of wildlife probably have not been identified. Some indigenous wildlife species are susceptible to foreign viruses

that have not been introduced. Caution should be exercised in working with suspected viral diseases, and good laboratory support is needed.

Rickettsiae: Although not known to be very prevalent in wildlife, certain infectious agents in this category have considerable implications for domestic livestock and human health, viz., anaplasmosis and Rocky Mountain spotted fever. Many rickettsial diseases of wildlife probably have not been identified.

Bacteria: Most wildlife species are vulnerable to an array of bacterial diseases, some of which are capable of inflicting heavy mortality. Season of the year and locale in the region are paramount factors to be considered in the occurrence of most contagious bacterial diseases.

Mycosis: Fungi infections do not rank high among the leading causes of morbidity or mortality in wildlife of the Southeast, but there are exceptions such as aspergillosis in migratory waterfowl. During the summer of 1977, aflatoxicosis precipitated considerable concern in this region.

Parasites: Various forms of endoparasites frequently inflict substantial morbidity and mortality in wild animals of the Southeast. This usually is associated with overpopulation, malnutrition, and the season of the year. Some have considerable implications for domestic livestock and public health.

Senility: Old age is not a significant mortality factor for wildlife. Environmental stresses and predation prevent this from happening. Annual turnover in wildlife populations is far greater than the general public realizes. Nature is not nearly as benevolent as most people like to imagine.

Upon arrival of a field team at the location of wildlife mortality, a general appraisal of the problem usually has been established through the suggested process of elimination and the more likely possibilities have been chosen. Caution nevertheless must be exerted to avoid a "specialty bias," which can frequently creep into field activities. The chief investigator therefore must strive to be a diagnostician and not a specialist in any given field.

An experienced, well-organized field team should arrive at a sound tentative diagnosis in two to five days. For many conditions, considerable laboratory work is in order and feasible only at the base of operations.

It is hoped that oversimplification is not suggested in this abbreviated account of the investigation of wildlife diseases. In fact, as a result of drastically changing socio-economic factors predicted for the remainder of this century, disease problems involving wildlife will increase and demands will be intensified for definitive information on the interrelationships between diseases of wild animals, domestic livestock, and humans.

The multi-billion dollar wildlife investment in the Southeast nevertheless will continue to thrive regardless of diseases currently existing in the

continental United States. Although there will be occasional setbacks, this resource will survive any mortality factors currently present in this country.

The major disease threat to wildlife of the United States therefore is not from within but from without in the form of a devastating foreign disease.[6] For example, in May 1978 the presence of African swine fever was confirmed in the Western Hemisphere. Authorities in the field no longer use the word *if* but *when* foot-and-mouth disease (FMD) is reintroduced into this country. Accelerated military/tourist/business travel, increasing demands for importation of meat and by-products thereof, worldwide use of biologics, international movement of animals, etc., pose an immediate likelihood of accidental foreign disease introduction.[7] Purposeful introduction of a devastating foreign pathogen also cannot be dismissed.[8] Either would exert a tremendous impact on vital segments of this nation's economy. Wildlife likely will be intricately involved to compound an awesome problem.

Officials of the U.S. Department of Agriculture have long recognized that the success of many livestock and poultry disease control or eradication programs may be dependent upon accurate information on diseases in wild animals either as principal, reservoir, or amplifying hosts. Some classical examples are the following: FMD in the Stanislaus National Forest, California, in 1924; cattle fever ticks in Florida during the eradication program in the late 1930's and early 1940's; Venezuelan equine encephalomyelitis in 1971; and exotic Newcastle disease in California, Florida, and Texas in 1972-73.

Indigenous livestock disease control programs have been hampered because of inadequate information on possible wildlife involvement, and eradication of certain exotic animal diseases may be entirely dependent upon acquisition of information in this area. Few animal disease control or eradication programs can be successful without adequate epizootiologic information on the variety of wildlife involved. Monitoring and surveillance of wildlife populations with parallel transmission studies, therefore, are prerequisites to control and eradication of indigenous or exotic diseases of domestic livestock and poultry. Information thus derived may mean the difference between successful eradication or allowing an exotic disease to become established.[9]

A timely example of a critical need for data of this type was at the onset of the exotic Newcastle disease eradication program of 1972-73 in southern California.[10] After a national animal disease emergency was declared by the Secretary of Agriculture on March 14, 1972, a major concern was for whether viscerotropic velogenic Newcastle disease (VVND) virus had become established in free-flying birds to spread from coast to coast. Early measures were taken to investigate this frightening possibility. Over 13,800 free-ranging domestic and wild birds were collected from sites designated as high risk areas. Virus isolation procedures demonstrated that VVND had not gained entry into wild bird populations but that it was a disease of confinement. This information proved invaluable to successful eradication of the disease in poultry of the United States.

Although makeshift field teams comprised primarily of temporary employees were reasonably effective in responding to an urgent need for valid data on wild birds during the exotic Newcastle disease eradication program, it was readily recognized that such an arrangement leaves much to be desired for coping with future animal disease emergencies. As a consequence of this experience and current problems of a similar nature, officials of Veterinary Services of the Animal and Plant Health Inspection Service (APHIS), USDA, recognized the need for developing an efficient, highly trained unit to work with state and federal wildlife agencies in obtaining information on diseases of resident wildlife that may be transmitted to domestic livestock and poultry.

In light of its past experience and expertise in this field, the Southeastern Cooperative Wildlife Disease Study was selected as the most appropriate institution through which this could be accomplished. Effective September 29, 1978, arrangements were finalized between APHIS and SCWDS to develop two highly specialized field teams to conduct nationwide epizootiologic studies directed toward studying diseases that concomitantly affect domestic livestock and poultry. The mission of this division of SCWDS will be to investigate the implications of wildlife for domestic livestock and poultry diseases of the United States.

Through these collective efforts, the purposes and objectives of wildlife disease investigations will be more fully realized and a wealth of information will be forthcoming to define more clearly the status of wild animals as reservoirs of diseases for domestic livestock and poultry and vice versa. This nation's wildlife interests therefore take this occasion to welcome APHIS, USDA as a partner in an unprecedented program from which the people of this country will benefit materially.

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DISEASE RECORDING AT THE FARM LEVEL

Stanley L. Diesch*

Beginning in 1955, the Minnesota Livestock Sanitary Board (MLSB) employed a postcard and questionnaire system to report cases of animal disease. Each month veterinary practioners voluntarily reported to the MLSB. In 1968-70, the postcard system produced only a six to eight percent mail back to the MLSB. Since populations at risk were not reported nor rates determined, this information was not considered meaningful, and in 1970 the postcard system was dropped.

In 1971, the Infectious Diseases Committee (IDC) of the Minnesota Veterinary Medical Association (MVMA) was asked to develop a meaningful disease reporting system. The resulting food animal disease reporting system in Minnesota has been a cooperative effort between the Minnesota Livestock Sanitary Board, which has official responsibility, and the members of the Minnesota Veterinary Medical Association.

The IDC developed the following reasons for reporting:

1. In order for the practicing veterinarian to recommend proper preventive measures to the livestock industry, surveillance of disease with a data base is essential.

2. To assist in eradication, control, and prevention of disease, regulatory agencies must have knowledge of when, where, and under what conditions disease occurs. It is the official responsibility of the MLSB to compile, edit, publish, and distribute this information.

3. Improved definition and control of the disease problems reduces economic loss to the livestock industry.

4. It encourages the livestock producer to have a better understanding of the value of veterinary service and early attack on disease.

5. It identifies disease problems for veterinary research and justifies research based on data indicating incidence and trends.

6. A meaningful data base gives the following information:

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a. indicators of incidence and changing trends,
b. geographic distribution of diseases,
c. knowledge of emergence of new diseases,
d. basis for certification of lack of diseases.

During 1971, the IDC developed procedures to report morbidity incidence of animal diseases. Cases of disease and populations at risk were reported each month so that incidence rates could be determined.

Information flow is based on disease morbidity information reported monthly by livestock producers and practicing veterinarians to the district veterinarians (state or federal), thence to the MLSB located in St. Paul. There the information is tabulated and quarterly and annual reports are printed out to be returned by reverse flow to the district veterinarians and livestock producers (Figure 1).

FIGURE 1. Schematic of Disease Reporting

Farm ⇄ Farm ⇅ Farm ⇄

Practicing Veterinarian

↓↑

District Veterinarian

↓↑

Minnesota Livestock Sanitary Board
St. Paul

↓↑

Computer Center
U. of Minn., St. Paul

Forms and guidelines used in reporting by veterinarians and farmers were developed by members of the IDC with input from practicing veterinarians and members of the MLSB and Veterinary Services, APHIS, USDA. The guidelines and reporting forms were designed so that the volunteer veterinarians and livestock producers would cooperate and not refuse to participate because of the complexity and time involved. Individual report forms for the veterinarians and the livestock producers were developed for beef herds, feeders, dairy herds, swine, and sheep.

In 1976, a major revision of the system was made in which the number of farms reported monthly by each practicing veterinarian was reduced from fifteen to five. Matabolic diseases and other conditions were added to the list of infectious diseases. Mortality reporting was added and the livestock producer was asked to estimate the dollar cost of each disease occurring on his farm each month.

CURRENT STATUS

The reporting system is based on actual animal surveillance by the livestock owner and the veterinarian. Diagnosis is primarily clinical with an unknown amount of diagnostic laboratory confirmation. The basic data unit is an animal month. The information reported is the occurrence or nonoccurrence of a new case in that animal during the month of surveillance. Basic data units are located according to the following scheme which is designed to enhance the direct and easy flow of information.

Minnesota is divided into thirteen districts, which define the agricultural regions of the state. Each region is internally homogeneous with respect to type of farmsteads. The veterinary practitioners form primary sampling clusters within each district; farmsteads (or herds) form secondary clusters of animals. All animals in a herd and the months in which the animals are actually under surveillance are tabulated. Minnesota has about 400 food animal practitioners, and in any given six month period about ten percent are drawn at random and asked to report. They are exempt if they have participated during the two previous years.

Each chosen practitioner makes a list of as many farmsteads as possible from which he feels he can elicit the quality of surveillance required. Five farmsteads are then chosen randomly from the list as those he will ask to cooperate. The procedure produces a stratified multi-stage cluster probability sample of the universe of farmsteads which would be capable of an adequate quality of surveillance.

The data are centrally accumulated and processed into incidence rate of new cases based on the denominator of number of animal months kept under surveillance for the period being reported. In addition, incidence rates of herds are also identified. Reports by computer (IBM 360-30) output can be made monthly, quarterly, or annually. For most diseases of substantial interest, it is possible to expect reporting precision of plus or minus three percent of the actual rate in the universe being sampled. The system is able to pick up trends easily and it is possible to hold lag time down to several months.

Initially, computer sheets with quarterly disease incidence rates were distributed to the veterinary practitioners by the MLSB. These were of little value to the practitioner or the livestock producer. Currently, monthly disease reports are interpreted and discussed by veterinarians in the monthly MLSB newsletter under a category called "Disease Alert." This information is useful to veterinary practitioners and livestock producers for preventive medicine and herd health.

Regulatory state and federal veterinarians find the reports useful in prevention, control, and eradication programs. Since 1971, a sufficient data base has been accumulated so that trends and evidence of emerging diseases can be determined. Researchers have found the information meaningful and of value in documenting and justifying that specific disease problems exist. The IDC has disseminated information to livestock

groups by publishing reports and discussions in farm magazines, extension newsletters, and bulletins.

DEVELOPMENT

Present plans are to continue the system. Since 1971, the system has been one of voluntary participation by the practicing veterinarians and livestock producers. It has become increasingly difficult to obtain the voluntary cooperation of these individuals. Efforts are being made to reimburse the private cooperators financially for their reporting services. Estimates are that the cost of this will be approximately $75,000 annually. The annual cost to the MLSB is approximately $27,000 and to Veterinary Services $27,000.

Before the Minnesota system can be recommended for other states it must be validated.

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EPIDEMIOLOGICAL DATA: ITS COLLECTION AND USE IN AVIAN DISEASE CONTROL

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Procedures to collect and report avian disease data were developed independently by four regional associations on the North American continent. The oldest of these is the Northeastern Conference on Avian Diseases (NECAD). It includes six Canadian provinces and thirteen states. The North Central Poultry Disease Conference (NCPDC) consists of twelve states. The Southern Conference on Avian Diseases (SCAD) represents eleven states. The fourth regional association, the Western Poultry Disease Conference, has no organized disease reporting committee. Its reports have been assembled each year at the request of the American Association of Avian Pathologists (AAAP) by concerned individuals. Data from Mexico have been submitted through the Western report.

Each report differed from the others in format, nomenclature, diseases listed, and in age and species categories. In order to reconcile these differences and make the reports compatible, if not identical, the AAAP appointed the principal reporters from each region to its committee on nomenclature and disease reporting. Agreement was obtained slowly. It required the exchange of views, study, and compromise over a period of five years. Various systems of veterinary nomenclature and their concomitant computer codes were reviewed. Eventually an *AAAP Guide to Disease Reporting* was published. This consists of a list of disease names used by poultry pathologists and diagnosticians. Beside each name are the minimum criteria which the committee believes are required in order to report a diagnosis. They may consist of nothing more than "History, symptoms, and lesions" or "Observe and identify." More often there are several sentences describing lesions, symptoms, and minimal lab procedures. If there are competing names for the same condition, the user is directed

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toward that which the committee believes to be preferable. For example, beside "Ornithosis" the user is told to "Report under chlamydiosis." Beside "Chlamydiosis" the user will then find the minimum criteria for reporting that infection.

Our experience in developing a nomenclature acceptable, at least for reporting purposes, throughout the United States, Canada, and Mexico leads us to a principle we believe pertinent to this symposium: *Where there are differing systems of nomenclature and reporting involving many individuals, laboratories, and governmental units, attainment of consensus on a single uniform system will be difficult and laborious, but probably more effective than imposition of another system from without, no matter how perfect it may be.*

Maintaining the consensus on format and nomenclature and updating the *Guide* require continuing effort. Although changes in the *Guide* are proposed and debated every year, we have found that a new edition about once every three years is practical.

USES

1. The reports provide a picture of the occurrence, distribution, and trends of avian disease. They provide a background and framework for laboratories and diagnosticians to confront a daily array of diagnostic problems. They draw attention to possibly "over diagnosed" conditions as well as possibly "under diagnosed" conditions. They provide a basis for comparison, internal quality control, and self-assessment. We believe this to be the most frequent and valuable use of the reports.

2. They foster the use of acceptable, standardized nomenclature. We believe the reports are effective in this effort, but we have learned that sometimes what is preferable from a pathologic or scientific viewpoint is not always possible in the face of established usage. The committee's policy is to give preference to etiologically based nomenclature wherever possible.

3. The reports point out overlapping and conflicting nomenclature and show up areas where more precise nomenclature is needed. This frequently occurs with new or emerging conditions where etiology has not been fully established. The current problem in turkeys variously called turkey respiratory complex, acute rhinotracheitis, and turkey coryza is an example. Until the etiology is worked out it probably cannot be established whether these are the same or different conditions. Another example is the emerging importance of adenovirus infections. Here at least three manifestations have been named as disease entities: egg drop syndrome, marble spleen disease, and inclusion body hepatitis. The question persists as to whether these common names should be used or whether there should be three subclassifications by virus type or pathology under the general heading of "adenovirus infection." While this pointing out of overlapping or conflicting nomenclature is a useful function of the report,

it is also a deficiency as mentioned in number two below.

DEFICIENCIES

1. Although informal communication is facilitated by the formal reporting network, the AAAP disease reports do not function as an early warning system because of the lag time between diagnosis and publication of the reports. The Southern Conference was able to publish a monthly regional report two months after the end of each reporting period. Even with this short lag time, it served no more than to confirm what diagnosticians in the field already knew when there was a significant increase in the frequency of some conditions. The overall report is usually published in *Avian Diseases* nine months after the close of the reporting period, which is the calendar year.

2. A satisfactory system of recording new or emerging conditions of unknown etiology has not yet been developed. We believe that such a system can be developed, however, and that this deficiency will be eliminated.

3. Although the AAAP reports accurately indicate relative frequency of different disease conditions in North American poultry, they do not measure prevalence. The diagnoses reported are not a random sample of the population at risk. Rather, they are a comprehensive listing of diagnoses made on birds submitted for cause. They are a fairly accurate representation of total incidence. It is possible to calculate incidence rates in a given state or region by utilizing available poultry population data. "Relative frequency" is the frequency with which different conditions occur relative to each other.

Experience with the development of this system indicates procedures, problems, and limitations that may be involved in developing similar reports for other species.

PROGRESS IN DEVELOPMENT OF THE AUSTRALIAN NATIONAL ANIMAL DISEASE INFORMATION SYSTEM

R. T. Roe*

The development of a national animal disease information system, as part of a comprehensive epidemiological service, is one of the responsibilities of the Australian Bureau of Animal Health (ABAH).[1] A proposal for the development of such an information system in three phases was made in 1976 by Morris.[2] This proposal was for the initial development of an information system to service the National Brucellosis and Tuberculosis Eradication Campaign. It envisaged the later expansion of this system to collect data from diagnostic laboratories and abattoirs relating to selected diseases. The ultimate goal is the development of an integrated disease survey and monitoring system on a national scale. This paper discusses the initial phase of the development of the Australian National Animal Disease Information System (ANADIS) which has now been established as part of the national brucellosis eradication campaign.

OBJECTIVES

The first phase of ANADIS has been established to provide a comprehensive data handling system, to assist in the day-to-day management of the brucellosis eradication campaign, as well as to establish a data bank that can be used for detailed epidemiological study.

Prior to the establishment of ANADIS a study was made of information systems in existence within Australia and overseas; also the information requirements of the various personnel involved in the eradication program were ascertained. A number of broad objectives were specified and the method of operation of the system was planned.

The objectives of the information system are as follows:

1. To provide field veterinary staff with comprehensive information on the history and current status of herds under their supervision, in order to assist in the interpretation of test results and the management of the eradication program in individual herds;

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2. To assist field staff in the forward planning of the campaign in their areas and in the scheduling of herds for retest;

3. To provide veterinarians, responsible for the administration of the eradication program (at each level of the administrative hierarchy), with up-to-date summaries of the progress of the eradication campaign;

4. To establish a method of monitoring progress in the eradication campaign at regional, state, and national levels in order to identify aspects which may require modification in the interests of achieving rapid eradication.

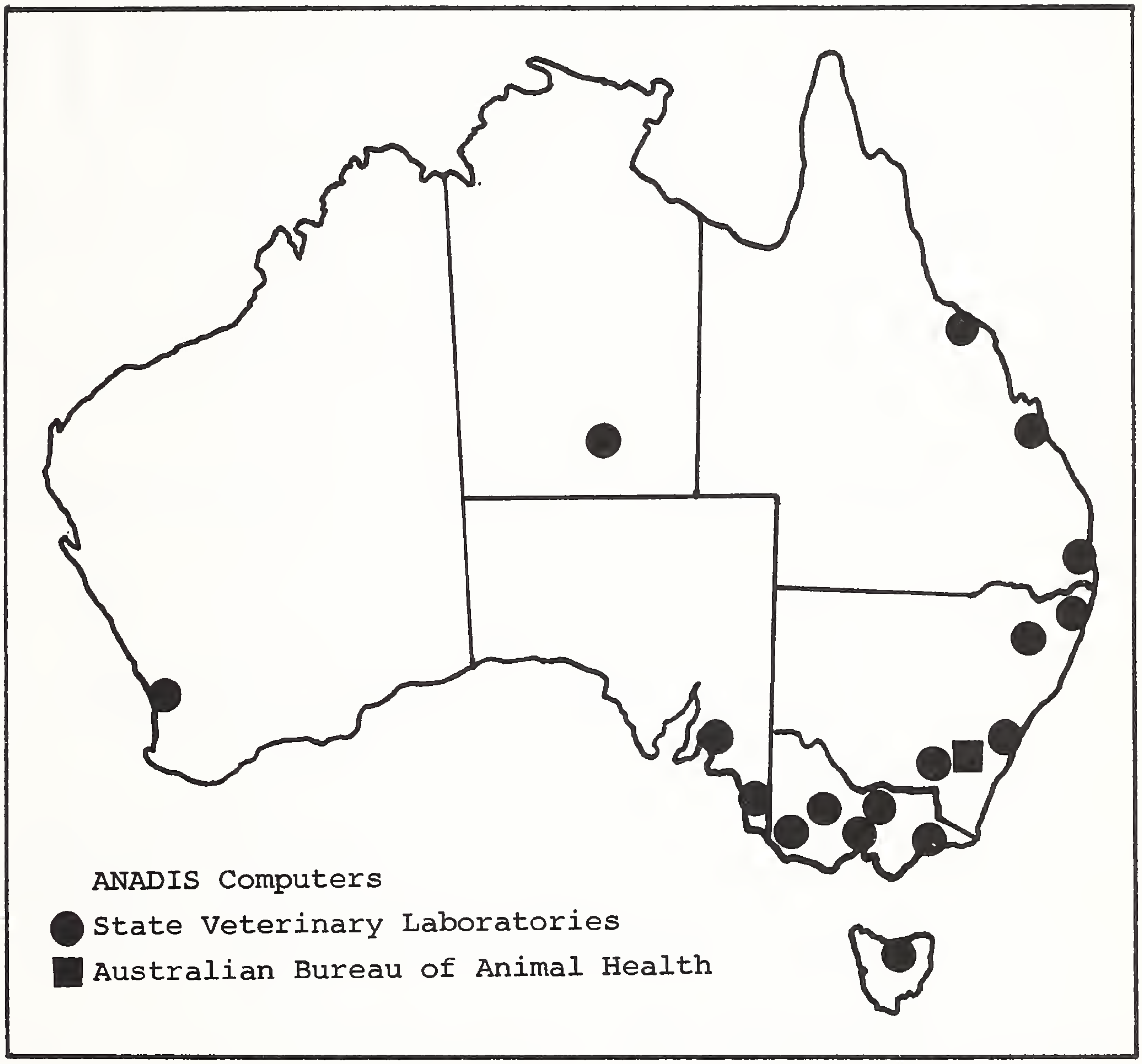
In achieving these objectives an important consideration was to avoid imposing any additional workload on veterinary staff and to reduce the clerical workload where possible. Any national system developed had to be adaptable to the individual requirements of each of the state Departments of Agriculture, which have statutory responsibility for disease control in their respective areas. Additionally, while developing an information system for the brucellosis eradication campaign along the lines of the long term plans for ANADIS, it was necessary that flexibility be retained within the scheme for future developments in livestock disease control at a state or national level.

STRUCTURE AND EQUIPMENT

ANADIS has been established as a computer-based, decentralized data recording service. A mini-computer has been installed at each of the eighteen veterinary diagnostic laboratories in Australia (Figure 1). Each computer operates independently. Records are maintained on each laboratory computer for all farms in the region serviced by the laboratory. Data are keyed in from laboratory report sheets through the computer terminal and directly update the farm records stored on disk. Input data is copied to floppy disk (a computer storage medium suitable for sending through the mail) and a backup copy of all data is maintained at the ABAH through a regular exchange of floppy disks on a weekly basis. Printouts of herd histories and statistical reports on eradication activities are produced automatically or on demand from the laboratory computer.

A similar computer (although with slightly larger memory and additional data storage capacity) is located at the ABAH. Consolidated records for all regions are maintained at the ABAH on magnetic tape. Data entered in one region relating to the records maintained in another region are exchanged between laboratories via the ABAH on floppy disk. All program development and maintenance and the statistical analysis of the data base are carried out at the ABAH.

FIGURE 1. Location of ANADIS Computers



MODE OF OPERATION

The system has been designed around a concept of simplicity of operation with built-in checks to prevent the entry of erroneous data. The computers are operated at each laboratory by typists with no special training in computer systems. An operator's manual has been prepared and the operators were given a brief period of instruction over three to four days following installation of the computers.

Data entry is interactive. The operator simply enters the name of the

procedures with which he wishes to deal, e.g. HERDTEST, VACCINATE, etc. Each of these words is the name of a computer program which handles that particular type of data. The entry of one of these words instructs the computer to "load" the corresponding program ready for data entry. For each item of data to be entered, the computer prints up a "prompt," a brief message indicating the item of information expected. The operator enters a response, and the computer program immediately checks the information to determine whether it is logically consistent with the records. If the entry is consistent, a new prompt is printed up. If the entry is inconsistent with the records, it is rejected and a message printed out to indicate the nature of the error. Typographical errors can be corrected immediately and, because the data are current, errors in the details on the laboratory reports can be checked and corrected in a short space of time. Thus errors which may influence action are detected and corrected in time. This is considered to be a great advantage which a decentralized, interactive data entry system has over the alternative of a centralized batch entry system.

Records are maintained of all activity relating to the national brucellosis eradication campaign. Separate computer programs are used for the entry of each type of data.

The following data entry programs are used:

OWNER	Enters property identification details including name, address, and phone numbers of the owner and the manager, property location, identification of the testing team, veterinary officer's file reference number, etc.
HERDTEST	For entering summaries of the results of all serological testing conducted on herds. Decisions by field veterinary staff on the number of animals classified as reactors are also entered through this program.
TRACEBACK	Details of abattoir monitoring test results are entered using this program.
MILKRING	Enters the results of milk ring tests.
VACCINATE	Details of vaccinations performed in a herd.
SETSTATUS	The brucellosis status of each herd is calculated automatically from the records, but may be overridden by the veterinary officer using this program.
SETSIZE	A record of the number of breeders in each herd is updated automatically from data entered on herd test results, but the record may be set by data entry when necessary.

An example of the data entry routine is illustrated for one of these programs in Appendix I.

A range of reports is produced to fulfill the different information requirements of officers involved in the brucellosis eradication campaign. Separate computer programs are used to produce each type of report. The following report generating programs are used:

HERDREPORT For producing a Herd Brucellosis Summary report (Appendix II). This is the most commonly printed report. Criteria can be specified to have these summaries generated automatically following the entry of certain classes of data or for particular results, for example, when a positive reaction is obtained from an abattoir monitoring sample in a herd previously tested clean. These Herd Brucellosis Summary reports can also be produced on demand for any herd whose records are maintained at that laboratory. Tear-off slips attached on the right hand side of the report are used by field staff to return information to the recording system when the field interpretation leads to some variation from the laboratory results initially recorded. Each new summary produced for a herd is retained by field staff as a current summary of the history for that herd, and the superseded summary discarded.

ACTIVITY Produces a report of Herd Testing Activity statistics (Appendix III). Flexibility in the computer programs for this and other reports permits the operator to specify reports for a particular district or region, or for the whole of the records, and permits the specification of the starting and ending date of the period covered by these reports. Thus, reports can be produced retrospectively for sections of the data base for detailed study when required.

STATUS Produces a Herd Brucellosis Status report (Appendix IV). This report is a transition matrix showing the numbers of herds whose brucellosis status changed in the period specified for the report. The Herd Brucellosis Status report focuses attention on the dynamic aspects of the eradication campaign by reporting indices of *progress* rather than the more traditional statistics that simply reflect control effort or *activity*.

ACTIONLIST A comprehensive and flexible program that is used to produce lists of herds that satisfy specified criteria. It is used for a variety of purposes, including the scheduling of herds for retest (Appendix V) and the listing of herds that have not fulfilled monitoring or vaccination requirements (Appendix VI). Lists can be printed of all herds of a specified brucellosis status in a specified area.

NAMELIST Produces indexes of all herds in a region either numerically, by registered number, or alphabetically by owner name.

Consolidated reports on both control activity and progress in the eradication program on a state or national basis are produced from the records maintained at the ABAH (Appendix VII). As the eradication campaign progresses, information in the data base will be used to derive parameter values for a previously developed computer simulation model of brucellosis, to facilitate forward planning and to extrapolate observed trends to predict future progress in the eradication program.[3]

DISCUSSION

ANADIS has an important role to play in the National Brucellosis Eradication Campaign. This campaign, which is the largest livestock disease eradication program ever undertaken in Australia, would be hampered without an efficient data recording and analysis system.

One aspect of the Australian campaign which is expected to result in considerable cost saving is the use being made of abattoir monitoring in detecting infected herds and monitoring brucella-free herds. The identification of the property of origin of slaughter cattle by tailtags, which has proved to be such a valuable aid in tuberculosis eradication, is also of great value in the eradication of brucellosis.[4]

Every property with cattle is identified in the information system by a unique eight character number. This number is also used as the tailtag number and, as it is compulsory for all cattle delivered to a saleyard or consigned for slaughter to carry a tailtag, the property of origin of all slaughtered cattle can be identified. The collection and testing of a blood sample from every breeder slaughtered provides a cost effective means of identifying infected herds. Extensive movements of cattle between the property of origin and point of slaughter occur in Australia. ANADIS facilitates the transfer of results from the laboratory where tests are performed to the laboratory where records for the property of origin are maintained, assuring early alerting of field staff to likely infected herds. This is achieved with a minimum of clerical work and without being hampered by protocols for exchange of information between states. In addition the accumulation of negative monitoring results on a herd may be sufficient to obviate the need for routine testing of herds in successive years to determine that they are remaining free of brucellosis. The collation of data on negative results from abattoir monitoring tests and the analysis of this data to determine the brucellosis status of herds would be an impossible task in the absence of a computerized information system such as ANADIS.

An effort was made during the establishment stages of ANADIS to overcome the initial apprehensions harbored by many of the operators and field staff who had, in general, no previous contact with computers. The operators have encountered few difficulties with the system and it has been readily accepted by field and laboratory staff. During the programming and development stages flexibility has been retained to permit the system to be adjusted to fit the requirements of particular states or regions. It is

expected that the value of an efficient computerized information system will become even more apparent as the National Brucellosis Eradication Campaign progresses.

The next stage in the development of ANADIS is to make use of existing livestock disease information from diagnostic laboratories and abattoirs. Substantial biases exist in the data from these sources, limiting their usefulness in drawing conclusions about the disease situation in the general livestock population. Nevertheless, if cognizance is taken of these biases, they do provide a valuable source of information about some diseases or aspects of certain diseases. The computerization of coded data relating to laboratory examinations and diagnoses will provide an index to this data. This will permit greater use to be made of a valuable data source for both disease control planning and epidemiological investigation.

In addition to providing traceback information in association with disease control programs, abattoirs can provide information on disease prevalence, distribution, and economic importance. A start has been made in this area to obtain information on selected diseases by planned surveys operated for a predefined period and integrated with field surveys directed at providing complementary information on the disease entity in question. This approach is in contrast with that frequently adopted in which an attempt is made to routinely record all information relating to pathological conditions observed at slaughter inspection.

The development of complementary abattoir and field surveys of livestock disease leads logically into the planned third phase in the development of ANADIS. The aim of this phase is to establish a disease surveillance system which would include both periodic broad surveys and continuous monitoring of the disease situation in the intervening periods. The periodic surveys would use a statistically selected sample of properties and be conducted at infrequent intervals (possibly every five to ten years). The emphasis in these surveys will be placed on intensive investigation of both the productivity of animals in herds and flocks and the occurrence and epidemiological behavior of disease agents which may influence these components of productivity. Monitoring of the disease situation between periodic surveys would be carried out in a smaller sample of herds and flocks to obtain information on disease conditions which fluctuate in importance, and conditions which emerge or change substantially in importance over the period.

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3. R. T. Roe, "The Use of a Simulation Model in the Planning and Evaluation of Brucellosis Control Programs," in *Proceedings of the 53rd Annual Conference of the Australian Veterinary Association, 1976*, pp. 30-32.

4. R. A. Hall, "Identification of Cattle for Disease Control Purposes," *Australian Veterinary Journal* 43 (1967): 220; P. B. Lewis, "Exploitation of Traceback and Computers in Disease Control Programs in Western Australia," in *Proceedings of the 53rd Annual Conference of the Australian Veterinary Association, 1976*, pp. 32-33.

APPENDIX I. Example of Data Entry. This illustrates the entry of abattoir monitoring test results using the TRACEBACK program. The items underlined were entered by the operator directly from the laboratory result sheet in response to the prompt printed out by the computer.

```
TRACEBACK


AM DATA ENTRY STARTING ON 15/09/78 AT 15:05:51


DO YOU WANT TO ALTER THE REPORT GENERATION PARAMETERS [Y/N]?      N


BACKUP FILE: LB09151505          SHEET:  1


ENTER Lab S.No.:     78/174
WHICH ABATTOIR?      51
 WE HAVEN'T GOT THAT ONE ON OUR RECORDS
ENTER DATE SAMPLES COLLECTED (DD MM YY) 12 7 78
WHAT IS THE FIRST BOTTLE NUMBER    1

Lab.S.No.:     78/174
ABATTOIR:      51
DATE:          120778
FIRST BOTTLE:      1
NEXT  BOTTLE:      1
ARE THESE WHAT YOU WANT [Y/N]?   Y
B001= PRAC246 N
B002= PRAC157 N
B003= PRAC204 16
B004= 'N
B005= PRAC128 N
B006= PRAC346 N
B007= PRAC901 N5
B012= PRAC017 8
B013= PRAC048 61
INVALID LAB RESULT
B013= PRAC017 16
B014= PJRAC067 N
B015= PARAC017 N
INVALID TAILTAG
B015= PRAC017 N
B016= '64
B017= PRAC001 N
B018= END
HOW MANY ENTRIES WERE THERE?     17
HOW MANY NON-NEGATIVE CFT'S WERE THERE?     4
CHECKING NON-NEGATIVE CFT'S
B003=        PRAC204 16
B012=        PRAC017 8
B013=        PRAC017 16
B016=        PRAC017 64


BACKUP FILE: LB09151505          SHEET:  2


ENTER Lab S.No.:     END
STOP END OF TRACEBACK
R
```

APPENDIX II. Example of a Herd Brucellosis Summary. An up-to-date summary is produced automatically for a herd when specified items of data are entered. These reports are retained by field officers as a summary of all eradication activities that have taken place in the herd.

HERD BRUCELLOSIS SUMMARY

TAG No: PARAC001 Printed: 2.11.78

VD: NACT LG: NACT

OWNER: SMITH, F J.
99 LONG ROAD, NOWHERE, 2999.

APPROXIMATE HERD SIZE:
138 BREEDERS ON 30.10.78

HERD TESTING SUMMARY:

				LAB FINDINGS				RESULT OF TESTS	
DATE	TYPE	Lab No	Total	U/S	RBT+	CFT?	CFT+	REACTORS	SLAUGH.
7. 9.76	SURVEY	08756	108	0	13	1	7	0	0
12. 9.77	E1	2678	148	0	24	5	18	18	18
25.10.77	E2P	2478	78	0	0	0	0	0	0
29.10.77	E2F	4567	52	0	4	4	1	5	5
4.12.77	E3	3679	125	0	3	0	0	0	0
25. 2.78	MISC	2978	4	0	0	0	0	0	0
5. 3.78	INTRO	4789	14	0	0	0	0	0	0
15. 6.78	C	7978	137	0	2	1	0	0	0
21. 7.78	RETEST	21278	8	0	0	0	0	0	0
30.10.78	C	5679	138	0	3	0	0	[ ]	[ ]

ABATTOIR MONITORING:

	DATE	No.	CFT+
LAST POSITIVE:	Mar 78	4	1 (HIGHEST TITRE 8)
LAST MONITORING:	Aug 78	5	0
CUMULATIVE 12 MONTHS TO	Nov 78	9	1
	approx	6.5% OF BREEDERS WERE MONITORED	

RECENT MILK RING TESTS:

DATE:	15. 1.78	12. 3.78	5. 5.78	12. 7.78	15.10.78
RESULT:	0	0	2	0	0

RECENT VACCINATIONS:

DATE:	Jun 76	Jun 77	Jul 77	Jun 78	Jul 78
S19:	18	15	19	24	5

HERD STATUS: TENTATIVELY PROVISIONALLY CLEAR

DATE:	12. 9.77	4.12.77	15. 6.78
STATUS:	IN	RD	PC

COPY FOR: V.O.
PARAC001
PLEASE COMPLETE BOTH COPIES AND RETURN SLIP
TO B.A.H. - CANBERRA

SMITH, F.J. ...

PARAC001 30 10 78 S____
REACTORS SLAUGHTERED

INDICATE STATUS: PC

PARAC001

SMITH, F.J. ...

PARAC001 30 10 78 P____
No. WITH BRUCELLOSIS

NA, SU, IN, RD, TN, MN, CF, AF

APPENDIX III. Example of a Brucellosis Testing Activity Report. Reports can be produced of the testing activity for any specified area and any specified time period.

AUSTRALIAN NATIONAL ANIMAL DISEASE INFORMATION SYSTEM

BOVINE BRUCELLOSIS ERADICATION PROGRAM

HERD BRUCELLOSIS STATUS REPORT FOR THE PERIOD 1/ 7/78 TO 30/ 9/78

AREA CONSIDERED: [PRA*] TAGS: PRAC000 - PRAC999

HERD STATUS ON 30/ 9/78	HERDS	CATEGORIZATION BY HERD STATUS AT 1/ 7/78								
		NA	SU	IN	RD	PC	TN	MN	CF	AF
NOT ASSESSED	379. (39.7%)	379.	0.	0.	0.	0.	0.	0.	0.	0.
SUSPECT	14. (1.5%)	2.	12.	0.	0	0.	0.	0.	0.	0
INFECTED	107. (11.2%)	26.	4	66.	10	1.	0.	0.	0.	0.
RESTRICTED	150. (15.7%)	2.	0.	50.	98.	0.	0.	0.	0.	0
PROVISIONALLY CLEAR	73. (7.6%)	0.	0.	0.	26.	47.	0.	0.	0.	0.
TESTED NEGATIVE	225 (23.6%)	61.	2.	0.	0.	0.	162.	0.	0.	0.
MONITORED NEGATIVE	0. (0.0%)	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONFIRMED FREE	7. (0.7%)	0.	0.	0.	0.	0.	1.	0.	6.	0.
ACCREDITED FREE	0. (0.0%)	0	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	955.	470.	18.	116.	134.	48.	163.	0.	6.	0.
		49.2%	1.9%	12.1%	14.0%	5.0%	17.1%	0.0%	0.6%	0.0%

HERD STATUS ON 30/ 9/78	HERDS	CATEGORIZATION BY NUMBER OF BREEDERS							
		UNKNOWN	1-19	20-49	50-99	100-199	200-499	500-999	1000+
NOT ASSESSED	379. (39.7%)	86.	169.	66.	30.	19.	9.	0.	0.
SUSPECT	14. (1.5%)	2	1	4	3	3.	1.	0.	0.
INFECTED	107. (11.2%)	1.	6.	24.	34.	33	9.	0.	0.
RESTRICTED	150. (15.7%)	0	22	29	65	29.	5.	0.	0.
PROVISIONALLY CLEAR	73 (7.6%)	0.	16.	18	32.	6.	1.	0.	0.
TESTED NEGATIVE	225. (23.6%)	4.	130.	47.	32.	9.	3.	0.	0.
MONITORED NEGATIVE	0. (0.0%)	0.	0	0	0	0.	0.	0.	0.
CONFIRMED FREE	7. (0.7%)	0.	5.	2.	0.	0.	0.	0.	0.
ACCREDITED FREE	0 (0.0%)	0	0.	0	0.	0.	0.	0.	0.
TOTAL	955	93.	349.	190	196.	99.	28.	0.	0

APPENDIX IV. Examples of a Brucellosis Status Report. These reports, in the form of a transition matrix of herd brucellosis status in the period covered by the report, are used to assess progress in the eradication campaign.

AUSTRALIAN NATIONAL ANIMAL DISEASE INFORMATION SYSTEM:

BOVINE BRUCELLOSIS ERADICATION PROGRAM
Printed: 1.11.78

HERD TESTING ACTIVITY IN THE PERIOD 1/ 7/78 TO 31/ 7/78

	AREA	VISITS [W/P/F] NUMBER	HERD TESTS [WHOLE/FINAL] NUMBER	POSITIVE		WAITING VET REPLY POS	SLTD	CATTLE TESTED GOVT	PRAC	TOTAL	POSITIVE		SLGHTD
FAC	ACTION	6.	6.	1	16.7%	0.	0.	100	148.	248.	2.	0.8%	2.
FAI	AINSLIE	1.	1.	0.	0.0%	0.	0.	5.	0.	5.	0.	0.0%	0.
FAR	ARANDA	6.	4	1.	25.0%	0	0.	450.	0.	450	1	0.2%	1.
FBEL **	BELCONNEN DISTRICT	13.	11	2.	18.2%	0.	0.	555.	148.	703.	3.	0.4%	3.
FBA	BARTON	58.	57.	15.	26.3%	3.	6.	2261.	0.	2261.	22.	1.0%	21.
FBR	BRADDON	1.	1.	1.	100.0%	0.	0.	132.	0.	132.	0.	0.0%	0.
FNCA **	NORTH CANBERRA DISTRICT	59.	58.	16.	27.6%	3.	6.	2393.	0.	2393.	22.	0.9%	21
FCU	CURTIN	6.	6.	2.	33.3%	1.	1.	199.	0.	199.	8.	4.0%	8.
FDE	DEAKIN	2.	2.	1.	50.0%	0.	0.	63.	0.	63.	1.	1.6%	1.
FDO	DOWNER	1.	1.	1.	100.0%	0.	0.	42.	0.	42.	5.	11.9%	5.
FWOD **	WODEN VALLEY DISTRICT	9.	9.	4.	44.4%	1.	1.	304.	0.	304.	14.	4.6%	14.
FEV	EVATT	4.	4.	1.	25.0%	1.	1.	122.	0.	122.	1.	0.8%	1.
FFA	FARRER	8.	7.	0.	0.0%	0.	0.	496.	0.	496.	0.	0.0%	0.
FFL	FLYNN	31.	31.	10.	32.3%	0.	2.	782.	0.	782.	21.	2.7%	21.
FFY	FYSHWICK	7.	4.	1.	25.0%	0.	1.	291.	0.	291.	7.	2.4%	7.
FWES **	WESTON CREEK DISTRICT	50.	46.	12.	26.1%	1.	4	1691.	0.	1691.	29.	1.7%	29.
FACT ****		131.	124.	34.	27.4%	5.	11.	4943.	148.	5091.	68.	1.3%	67.

NOTE: The number of positives and slaughtered is inferred from CFT results for those cases still awaiting vet. confirmation. Each test will be included in the totals if the herd is tested more than once in the period.

APPENDIX V. Example of a Herd Retest Schedule List. The interval at which herds of differing brucellosis status are to be retested may be specified and lists produced automatically of all herds fulfilling the criteria.

(PRAC) TAGS: PRAC000 - PRAC999 PAGE 0001

TESTING SCHEDULE: 30.10.78 - 27.11.78

TAG	ST	SIZE	REASON		OWNER NAME
PORAC090	TN	108	E1	12.05.78	EDLINGTON, M J. & J.C.
PARAC212	TN	112	E1	16.05.78	MCMASTER, A.A. & F.P.
PJRAC171	TN	4	E1	17.05.78	KILLEN, G.L. & E.D.L.
PIRAC276	TN	4	E1	17.05.78	O'ROURKE, E.P.
PDRAC330	TN	11	E1	17.05.78	SELLS, J.A.M.
PDRAC365	TN	3	E1	17.05.78	TONG, L.A.
PERAC340	TN	211	E1	23.05.78	STUART, D.M. & M.
PERAC332	RD	137	E2	30.05.78	SHEPHERD, A.R N.

(PRAC) TAGS: PRAC000 - PRAC999 PAGE 0001

APPENDIX VI. Example of a List of Herds Which Have Not Had Any Brucellosis Vaccinations Recorded in a Specified Period

(PRAC) TAGS: PRAC000 - FRAC999 PAGE 0001

HERDS WITH NO VACCINATIONS between 1.10.77 - 30. 9.78
HERDS WITH SOME VACCINATIONS between 1. 7.77 - 30. 9.77

TAG	ST	LAST VA	OWNER NAME
PGRAC010	TN	01.07.77	ADAMSON, J.T.
FBRAC011	TN	30.09.77	ANDERSON, K.& B
PARAC028	TN	01.07.77	BROWN, N.S. & R.E.
PGRAC029	TN	01.07.77	TARAWA PTY. LIMITED.
FIRAC030	NA	30.09.77	BRUCE, N.E.
PFRAC051	TN	01.07.77	CARGHILL, C.M. & G.D.
PGRAC053	TN	30.09.77	CAVANAGH, J. & J.
PARAC060	TN	01.07.77	CRAWFORD, J.R. & G.
PGRAC061	TN	30.09.77	C.S.I.R.O.,
PCRAC080	TN	01.07.77	DOWLING, E.J. & N.
PIRAC081	NA	30.09.77	DONALD, L.M. & R.
PERAC092	TN	01.07.77	ELLIOTT, N.S.
PHRAC100	TN	30.09.77	FITZHARDINGE, L.F.
PJRAC104	TN	01.07.77	FLEMING, G.T.

(PRAC) TAGS: FRAC000 - FRAC999 PAGE 0001

APPENDIX VII. Example of an Annual Statistics Report

AUSTRALIAN NATIONAL ANIMAL DISEASE INFORMATION SYSTEM:

BOVINE BRUCELLOSIS ERADICATION PROGRAM
ANNUAL STATISTICS 1. 7. 77 - 30. 6. 78

UTOPIA REGION

BASIC STATISTICS

TAILTAG REGISTRATIONS	783.	# WITH MRT	68.
EXCLUDING NB/DB	21.	# INACTIVE HERDS	210.
# "HERDS"	762.	HERD PREVALENCE	2. 6%
# BREEDERS	52340.	CATTLE PREVALENCE	0. 5%

PROGRESS

HERD STATUS	STATUS 1. 7. 77		GAIN	LOSS	STATUS 30. 6. 78		NA	SU	IN	RD	MN	TN	PC	CF	AF
							CLASSIFICATION OF STATUS ON 1. 7. 77 BY STATUS ON 30. 6. 78								
NOT ASSESSED	435	56. 4%	2.	241.	196.	25. 7%	196.	0.	0.	0.	0.	0.	0.	0.	0.
SUSPECT	5.	0. 7%	38.	35	8.	1. 0%	6.	0.	0.	0.	2.	0.	0.	0.	0.
INFECTED	33.	4. 3%	20.	33.	20.	2. 6%	6.	1.	3	0.	0.	5.	3.	2.	0.
RESTRICTED	12.	1. 6%	33.	1.	30	3. 9%	3.	1.	25.	1.	0.	0.	0.	0.	0.
PROVISIONALLY CLEAR	24	3. 1%	20	4.	40.	5. 3%	0.	3.	5.	11.	0.	0.	21.	0.	0.
TESTED NEGATIVE	137	17. 8%	53	10.	180.	23. 6%	53.	0.	0.	0.	0.	127.	0.	0.	0.
MONITORED NEGATIVE	120.	15. 6%	162	2.	280.	36. 7%	162.	0.	0.	0.	118.	0.	0.	0.	0.
CONFIRMED FREE	5.	0. 7%	5.	2.	8	1. 0%	0.	0.	0.	0.	0.	5.	0.	3.	0.
ACCREDITED FREE	0.	0. 0%	0	0	0	0. 0%	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	771.				762.		BREAKDOWN TO INFECTED					5.	4.	2.	0.
NIL BREEDERS	12.		2	0.	14.		2.	0	0.	0.	0.	0.	0.	0.	0.
DISBANDED	0		7.	0.	7.		7.	0.	0.	0.	0.	0	0.	0.	0.

MONITORING

	ABATTOIR		MILKRING		MISC		TOTAL		ABORTION
# BLOODS SAMPLED	28841.				17878.		46719.		
# BLOODS POSITIVE	164.	(0. 6%)			25.	(0. 1%)	189.	(0. 4%)	
# HERDS TESTED	439.		56.		101.		467		
# HERDS POSITIVE	45	(10. 3%)	6.	(10. 7%)	10.	(9. 9%)	58.	(12. 4%)	
# HERDS BECOMING SUSPECT/INFECTED	22.	(2. 9%)	6.	(0. 8%)	10.	(1. 3%)	38.	(5. 0%)	
# HERDS ADEQUATELY MONITORED	84.	(11. 0%)	50.	(73. 5%)	8.	(1. 1%)	222.	(29. 1%)	

ERADICATION TESTING

	HERDS TESTED	VISITS (W/P/F)	HERD TESTS (W/F) NUMBER	POSITIVE		CATTLE TESTED GOVT	PRAC	TOTAL	POSITIVE		SLGHTD
INITIAL HERD TESTS	73.	87	73.	20.	27. 4%	6440.	2120.	8560.	109.	1. 3%	107.
SUBSEQUENT HERD TESTS	59	128.	113.	70.	62. 0%	4240.	1620.	5860.	54.	0. 9%	54.
CONFIRMATORY TESTS	20.	24	22.	2.	9. 1%	1800.	324.	2124	5.	0. 2%	5.

TEST NUMBER OF LAST TEST IN PERIOD	1	2	3	4	5	6	7	7+	# HERDS
LAST TEST CLEAN (%)	80. 0	10. 0	5. 0	3. 0	2. 0	0. 0	0. 0	0. 0	66.
LAST TEST POSITIVE (%)	60. 0	20. 0	10. 0	5. 0	3. 0	2. 0	0. 0	0. 0	40.

VACCINATIONS

	HERDS	DOSES
STRAIN 19	33	442
45/20	1.	1292

SEROLOGY

	# RBT	% POS	# CFT	% POS	OTHER	% POS
FIELD	18233.	15. 3	0	0. 0	0	0. 0
LAB	45030	14. 3	6703	5. 3	0.	0

DEVELOPMENT OF A POISONOUS PLANTS DATA SYSTEM: A POTENTIAL U.S.-AUSTRALIA COLLABORATION

C. Garrow*

The United States and Australia span a number of climatic zones ranging from sub-temperate to tropical and their pastures cover arid regions to those of high rainfall. Not surprisingly the natural feeds encountered by domestic animals in both countries include a variety of plants with varying degrees of toxicity.

While there is an extensive literature on the subject and authoritative texts such as Everist's *Poisonous Plants of Australia* exist, the accession of relevant information is somewhat tedious and difficult. Further, revisions of published texts occur at infrequent intervals so that accession of up-to-the-minute information becomes even more difficult.

The Central Library, Information and Editorial Section (CILES) of Australia's Commonwealth Scientific and Industrial Organisation (CSIRO) is collaborating with Dr. C. C. Culvenor, CSIRO Division of Animal Health, in designing a data base containing a mixture of coded and textual information. The system to be produced, which is currently at an early stage of development, is expected to consist of three separate major files, the Plant File, the Toxic Constituents File, and the Bibliographic File. Although separate, the files are to be linked by a unique plant reference code constructed from abbreviations of the genus and species of each plant.

Information in the Plant File will include

- botanical name, genus, species, and family;
- common name(s) and description(s);
- geographical distribution;
- toxic constituents and level;
- effects on animals.

Of these, the first three categories will contain textual information and the last two will be coded according to a scheme yet to be designed.

Similarly the Toxic Constituents File will include chemical structures which should follow a standard structure classification scheme and methods

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of assay which may or may not be coded information.

The Bibliographic File will contain free-form textual information on authors, title, and source, cross-referenced to the plants by the reference code, and *Chemical Abstracts* reference and CAS registry number where relevant. It may in addition contain some unpublished information from herbaria or laboratories.

Initially it is intended that output will consist of tables set on microfiche and printed lists, including the following:

(1) Tables of plants against geographic distribution, botanical names cross-referenced to common names, plants against toxic constituents, and plants against disease.

(2) Lists containing bibliography, plant listings describing known effects on animals (an expansion of the final microfiche table listed in (1)), animals (a relatively small list) with diseases and possible causes (plants) listed, and perhaps a toxin list with methods of assay described.

In the United States a similar system is being designed by Professor J. M. Kingsbury, Professor of Botany and Lecturer in Poisonous Plants, Cornell University. It is planned to bring both systems together so that the *Poisonous Plants Data System* will provide for the storage and retrieval of data on the toxic plants of both the United States and Australia and will be readily accessible by scientists of both countries.

SECTION III

LABORATORY AND CLINICAL DATA

Howard M. Hayes, Jr.,
Chairperson

INTRODUCTION

Laboratory and clinical data systems have undergone quantum changes in the last twenty years. From the three by five index card and McBee Needle Sort systems kept by individual clinics, the state-of-the-art has grown to encompass information storage and retrieval with direct interaction between most North American veterinary teaching clinics via a central computer. The Veterinary Medical Data Program (VMDP) with a standardized disease and surgical coding scheme, the *Standard Nomenclature of Veterinary Diseases and Operations* (SNVDO), is the foundation for this. It is described in this section by H. M. Hayes, Jr., G. P. Wilson, and H. Moraff. The most recent implementation of a VMDP-like system is by the University of Florida College of Veterinary Medicine. M. J. Burridge and S. M. McCarthy report on that data system. It has many new features (e.g. the Virtual Storage Access Method, VSAM) and may serve as another model for a clinical data registry.

Laboratory data systems are as diverse as the definition of "laboratory." The system can be tailored to the individual facility, such as the Missouri Laboratory Animal Data System,* or be national in scope as is the Laboratory Animal Data Bank (LADB), described in this section by F. P. Gluckstein, T. E. Doszkocs, and W. G. Hoag. "Laboratory" in a broader sense may apply to animal slaughter data collected by the United States Department of Agriculture or that in other countries such as in the Danish Swine Slaughter Inspection Data Bank. Various applications of epidemiology have been performed with data collected by the latter and are outlined here by P. Willeberg.

The data systems reviewed in this section show the continuing improvement in the capturing, storage, and retrieval methods for medical data.

Howard M. Hayes, Jr.,
Chairperson

*J. E. Wagner, "A Computerized System for Retrieval of Case Information in a Veterinary Diagnostic Laboratory," *American Journal of Veterinary Research* 40 (1979): 436-442.

THE VETERINARY MEDICAL DATA PROGRAM (VMDP): PAST, PRESENT, AND FUTURE

Howard M. Hayes, Jr.,
George P. Wilson,
Howard Moraff*

HISTORY

The standardized collection and computerized storage of veterinary clinical information began in March 1964. This pioneer medical information registry, the Veterinary Medical Data Program (VMDP), was conceived and initiated by Dr. Richard Tjalma, when he was a member of the Epidemiology Branch, National Cancer Institute (NCI).[1]

The VMDP began with data collection at Michigan State University's veterinary teaching facility in East Lansing, Michigan. Fourteen universities subsequently joined the program while it was under the direction of NCI as a contract-supported research activity. Beginning in July 1977 the management and responsibility for the VMDP was assumed by the Association of VMDP Participants, Inc. The VMDP now collects and stores data from sixteen North American veterinary universities, including two from Canada (Table 1). Another five schools are expected to join the program in the near future.

During the past decade the VMDP has been the model for a veterinary data collection program sponsored by the World Health Organization[2] and independent programs at various universities in Australia, Finland, Germany, Ireland, Kenya, Mexico, and New Zealand.

The foundation of the VMDP is the use of a standardized numerical coding scheme, currently the *Standard Nomenclature of Veterinary Diseases and Operations* (SNVDO).[3] SNVDO is based on the *Standard Nomenclature of Diseases and Operations;*[4] however, SNVDO has expanded topography and etiology fields and the classification is tailored to veterinary terminology.

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TABLE 1. Active Contributors to the Veterinary Medical Data Program (VMDP)*

Auburn University	Michigan State University
University of California (Davis)	University of Minnesota
Colorado State University	University of Missouri
University of Georgia	Ohio State University
Iowa State University	University of Guelph
University of Illinois	University of Saskatchewan
Purdue University	University of Tennessee
Kansas State University	Texas A & M University

*Inquiries about the VMDP may be addressed to Dr. Howard Moraff.

SNVDO has been or is used as the coding scheme in other data collection programs for zoo, laboratory animal, and pathology information registries.[5] SNVDO offers far more specificity regarding notation for neoplasia than other currently available numerical coding schemes (e.g. *International Classification of Diseases for Oncology*), but SNVDO does have faults and will be revised again.

Another integral part of the VMDP is the required minimal collection of standardized data items by trained medical records personnel. The VMDP protocol calls for information to be collected on each individual patient seen at the treatment facility. The fourteen data items currently abstracted include medical diagnoses (≤ 3), surgical procedures (≤ 2), a unique patient number, date and status of discharge, species/breed, sex, age, and weight (Table 2). The latter two items are in interval format (e.g. two through three years of age) rather than specific notation. The patient's breed is ideally based on pedigree but, more commonly, the phenotypic appearance of the animal.

TABLE 2. Items of Standardized Data Abstracted on the VMDP Record

Institution	Discharge status
Patient number	Age
Date of discharge	Weight
Length of hospital stay	Diagnosis (es)
Attending clinician	Surgical procedure(s)
Sex	Non-diagnostic procedure
Species/breed	Diagnostic procedure(s)

The present record length for the abstract is eighty characters, with all possible fields coded. Beginning next year the number of codable diagnoses will be expanded to five and the number of surgical procedures to four.

CURRENT PROCEDURES AND STATUS

Many participants code information from their summary clinical records to pre-printed abstract forms, then process these data onto computer tape and forward it to the central repository maintained at Cornell University. Other participants code their data directly to computer readable form off the summary record, thereby skipping the abstraction phase. All submissions and retrievals to and from the historical file are currently in the batch mode.

In the near future, new programs will be in operation enabling participants to submit data interactively via terminals connected by telephone and commercial data networks to Cornell's computer. This mode of operation is expected to reduce errors (which are costly to correct in the current scheme), thereby improving the quality of data stored. Retrievals may be handled in a similar fashion.

The VMDP processed its millionth abstract record in June 1974. As of July 1978, it has compiled data on more than 1.8 million hospital events. About sixty-one percent of the records concern dogs, seventeen percent cats, and thirteen percent horses. Neoplasms were diagnosed in three percent of the visits and congenital or developmental defects in five percent. Since data collection began, approximately 10,000 dogs have been diagnosed with microscopically confirmed cancers, excluding those with skin malignancies only.

PROBLEMS

Several biases are inherent in veterinary hospital-based registries. Some of the more notable ones are the infrequent presentation of stillbirths and animals with severe congenital anomalies, particularly if they are from commercial breeding establishments; the possible reluctance by owners of mongrel pets, because of the pets' limited value, to bring them to medical attention; the possible financial inability of low-income owners to afford medical treatment for their sick pets; the lack of owner knowledge about an older animal's previous medical history, as well as its age; variations in owner interpretation of abnormal (sick) behavior of their pets; and variations between different hospitals in clinical interest, histopathologic criteria, record keeping procedures, and in disease terminology.

There also are facets of the present VMDP scheme which are less than ideal. Several errors, omissions, and duplications have been or are currently evident in the SNVDO or *Coding Supplement*.[6] Other coding problems include an inability to discern right and left organs in the coding of topography, and distinguishing between confirmed and suspected disease. The former is notable since it is impossible to determine from the collected data, for example, if a male cryptorchid animal was unilaterally or bilaterally castrated.

The lack of specific data on age and particularly weight has posed restrictions on several investigations. Canine osteosarcoma,[7] hydrocephalus,[8] and elbow disease[9] each appear to occur in association with patient weight. But to evaluate these potential etiologic factors further, better information on patient weight is needed.

Some universities have chosen to use the problem-oriented medical record,[10] which often results in more diagnosed diseases than can now be coded (N=3) on one VMDP abstract record (the system accepts only one record per date). Most likely, less severe diseases, such as parasitism or metastasis, are not recorded. Future expansion of the data record should reduce this problem. It is to be hoped that a variable length record will be adopted sometime in the future.

The referral population seen at any teaching facility is dependent upon the particular expertise offered. Identification of this group of animals from the abstract records has not been possible in the past. It is planned that by 1980 the postal zip code (of the premises where the animal lives) will be abstracted. With this particular data item, a better comparison of disease characteristics between animals from known different environments, such as rural versus urban areas, can be made.

PRESENT USES AND FUTURE APPLICATIONS

Despite the many potential problems, the VMDP has been the leading source of veterinary clinical information for research. The collected information lends itself quite readily to case-control analysis. The control population may be selected on some particular criterion, or general hospital population statistics may be generated by tabulating each animal once for each year it is seen for any reason (species, age, and sex specific patient years at-risk). Deleting case visits subsequent to the first diagnosis creates an appropriate hospital population at-risk. Measuring the representation of a particular characteristic in the case series versus the control population can be accomplished by the relative risk (RR) techniques described by Dr. John Gart.[11] His method permits controlling for known confounding variables and provides statistical confidence intervals for the calculated summary RR value.[12]

Data from the VMDP are the basis for more than seventy scientific investigations published in refereed human and veterinary journals. This

research has identified numerous similarities between the epidemiology of canine cancer and cancer in people[13] and provided some evidence that the frequency of spontaneous animal carcinoma may be influenced by exposure to surrounding industrial activity.[14] Investigations concerning congenital and developmental defects also have been undertaken. Again, a similarity between the animal and human experience has often been demonstrated.[15]

The data collected at the hospital level offer an excellent teaching media. Using a data retrieval mechanism, the student can quickly identify patients having a specific characteristic or disease entity. Review of the medical records provides first hand appreciation of "good" record keeping protocol or the lack of such. A short epidemiologic analysis of the series will provide the history of the condition as seen in that particular hospital. Hospital statistics on the local level also can be of great value to the management of the treatment facility. Information readily available includes patient load, number of vaccinations, number of operations performed, and the average number of hospital days spent per unit of time.

Changing breed popularity, better owner awareness, and new diagnostic techniques mandate a continuing review of the newly available hospital data. There is no reason to believe that the epidemiology of disease in animals remains stable over time. In fact, present and future studies, particularly of neoplasia, may require accommodation for time trends in the various analyses.

The VMDP completes its fifteenth year of operation in March 1979. Its acceptance by the academic community is predicated on the accommodation of the contributors' needs with respect to equal access to the data. With improved data standards, SNVDO coding scheme, collection and retrieval techniques, and a new responsiveness to user needs, the VMDP in future years will continue to grow in worth.

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THE DANISH SWINE SLAUGHTER INSPECTION DATA BANK AND SOME EPIDEMIOLOGIC APPLICATIONS*

Preben Willeberg**

Meat inspection data have been used in many countries in surveillance of farm-animal populations for disease occurrence, as well as in tracing affected herds as part of national control programs.[1] Extensive use has also been made of slaughterhouse information in ad hoc studies of various disease conditions to evaluate epidemiologic aspects such as geographical and seasonal trends, variations among herds, and influence of housing and management factors.[2]

Few examples exist, however, of integrated use of routinely maintained slaughter inspection data banks. A recent review of farm-animal disease data banks mentioned only one such system, in Northern Ireland, but no examples of its applications were given.[3]

In Scandinavia, however, at least two data banks containing slaughter inspection findings have been in operation for several years, and both have been extensively used in epidemiological investigations. In Sweden, a single-slaughterhouse system was devised in 1970 by local veterinary research institutions to help develop and organize applications of swine slaughterhouse statistics in veterinary preventive programs, and a number of epidemiological investigations have since been published.[4]

In Denmark a central data bank comprising most of the swine slaughterhouses has been maintained since 1964. The present report gives a basic description of the Danish system and reviews a number of its applications in areas of epidemiological interest.

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THE DANISH SWINE SLAUGHTER INSPECTION DATA BANK

The system was designed by the Danish Meat Research Institute and the LEC computer center, which was founded by the national farmers' cooperative associations. The aim was to create a tool for surveillance of health and disease among the Danish bacon pigs; the system was also to provide a sound basis for decisions regarding the development of disease-control programs.

The keystones in the system were (1) a centralized, computer-based bookkeeping system for cooperative bacon factories; and (2) a uniform code list of diagnoses from the meat inspection regulations to specify the lesions causing partial and total condemnation of affected carcasses.

The traditional marketing system for Danish bacon pigs implies a relatively simple flow of information: The producers ship their bacon pigs directly to the local slaughterhouse. Slap-tattooing at the pick-up establishes a direct link between any pig carcass and its herd of origin. Losses due to partial or total condemnations are carried by the producer as deductions in the amounts that would normally be paid by the cooperative.

Data on herd identification, weight, classification, sex, etc., are contained in the computer files, and by special arrangements even individual or litter identification codes may be provided. The slaughter inspection diagnoses are coded as two-digit numbers which can be grouped into twenty to twenty-five clinically relevant categories. Each affected carcass can have one or two diagnoses recorded. All diagnoses are made by licensed veterinarians since lay meat inspectors are not employed in slaughter inspection in Denmark.

Data from approximately eighty percent of the ten to twelve million Danish bacon pigs slaughtered annually are stored and processed on the central computer from which herd owners receive payment checks with specifications such as, for example, deductions by diagnosis made at the slaughter inspection.

The computer center summarizes the weekly data by herd within each slaughterhouse; in addition, monthly and yearly disease statistics by slaughterhouse are made available to the Danish Meat Research Institute. Summary files containing rates of diagnoses by sex, week, and slaughterhouse are maintained on magnetic tapes for two years.

SOME EPIDEMIOLOGIC APPLICATIONS

Examples of epidemiologic applications of data from the above-described system are summarized in Table 1; the studies have been cross-classified according to the level at which the data were compiled (herd, slaughterhouse, or national) and by primary epidemiological aim (causes, costs, or

TABLE 1. Examples of Epidemiologic Use of Slaughter Inspection Data; Objectives and Diseases Evaluated, by Application Area and Population Level*

Level of Data Compilation	Primary epidemiologic application		
	Causes	Costs	Control
Nation	Regional, temporal, climatic factors; Mycotoxic Porcine Nephropathy (MPN)[5]	Estimates and trends from national statistics; tail-biting, SEP**	Surveillance and trace-back of reportable diseases, e.g. TB
Slaughterhouse	Size, management, housing of herds; tail-biting, SEP**	Correlation between herd prevalence and overall feed conversion; SEP**	Regional campaigns, surveillance of SPF herds, screening for problem herds; ascarids, SEP**
Herd	Sex, history or treatment of litters, pens, or individual pigs; MPN, tail-biting, SEP**	Weight gain in subclinical cases; SEP[6]	Clinical trials, genetic selection, herd health programs; all diseases

*Most of the studies on which this table is based are unpublished or only available in Danish; reference has been assigned only to reports published in English.

**See text for details on swine enzootic pneumonia (SEP).

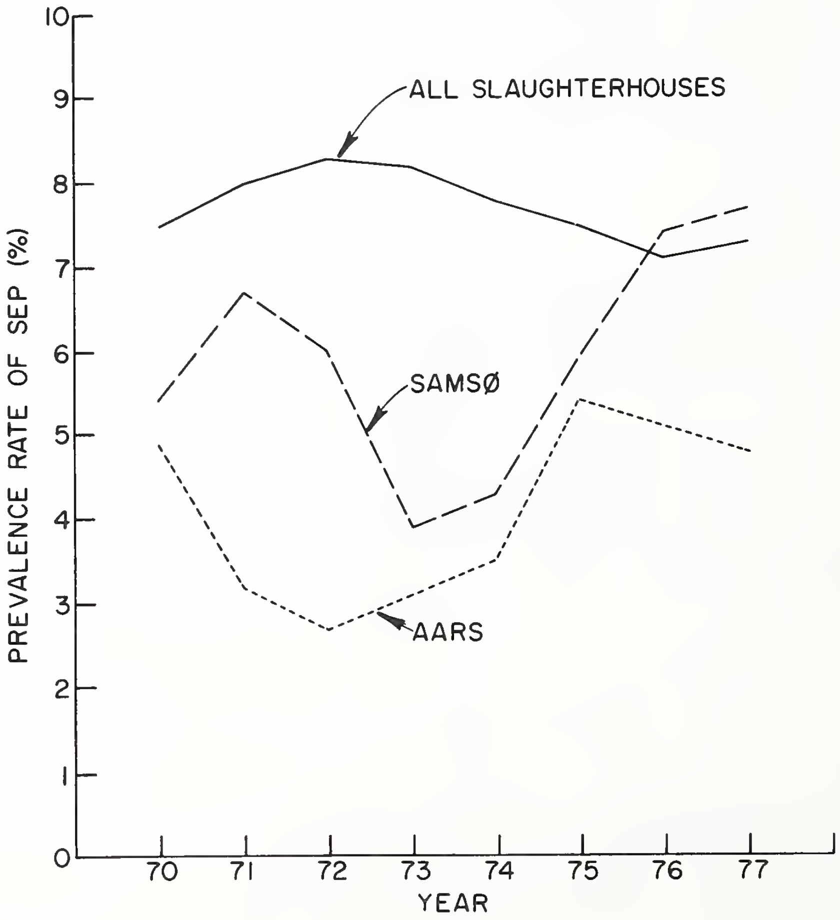
control).

A number of studies relating to respiratory disease will be discussed in more detail to illustrate the potentials of the data bank.

Enzootic Pneumonia in Danish Swine

From the country-wide statistics, it appears that lesions of the lungs and pleura comprise approximately two-thirds of all diagnoses made at any time; during 1964-1972, the prevalence of lesions increased gradually, but since 1972 there has been a steady regression in the yearly rate of respiratory lesions and, consequently, in the overall disease rate at slaughter (Figure 1).

FIGURE 1. Yearly Prevalence Rates of Lesions Associated with Swine Enzootic Pneumonia (SEP) from Danish Slaughterhouses. The slaughterhouse on Samso ran a campaign against *Ascaris suum* from February 1972 through March 1975, while no organized control programs were carried out in the region of the Aars slaughterhouse.



Among affected lungs sampled from Danish slaughterhouses in 1971, ninety-five percent were found to be affected with *Mycoplasma suipneumonia*.[7] The associated disease, known as swine enzootic pneumonia (SEP), is very prevalent in most swine-producing countries, and it is a major economic problem unless effective control programs are developed. The economic loss is a result not only of the local and total condemnations but also of the costs associated with treatment of clinical cases as well as a reduced weight gain and poor feed conversion.

The Danish Meat Research Institute responded to the serious situation, which appeared from the slaughterhouse statistics for the initial period after 1964, by establishing in 1970 an SPF (specified pathogen free) program in which commercial bacon pigs were produced from SPF-derived piglets. This scheme has so far been very successful, and it constitutes the only organized control program currently in use against SEP in Denmark. The program still has a limited capacity; for example in 1977 less than two percent of all pigs slaughtered were SPF-derived. Alternative actions based on local epidemiologic information are, therefore, still of great importance.

The Prevalence of SEP at Slaughter during a Regional Ascaris Campaign[8]

In 1972, the slaughterhouse on the island of Samso decided to start a local campaign against *Ascaris suum* in order to reduce the losses from livers condemned with milkspots. Anthelmintics and educational material were provided free for all herds over a three-year period. Figure 1 shows how the prevalence of lung lesions at slaughter resulting in partial or total condemnation changed during the campaign. The monitoring of this epidemiologic experiment was based solely on disease prevalence at slaughter for the period. The results were taken as epidemiological evidence for the earlier experimentally shown causal effect of migrating ascaris larvae on mycoplasma lung infections and for the feasibility of ascaris control programs. The epidemiological evidence, however, may be questionable since changes similar to those in the Samso statistics can be observed during the same time period for other slaughterhouses that did not have control campaigns (Figure 1). This problem could have been circumvented by keeping some herds on Samso as a control group not participating in the campaign. Furthermore, the veterinary meat inspectors, who were also involved in the control campaign, could then not have been suspected of bias in detecting SEP pigs since they would have been working with pigs from treated and control herds among each other not knowing the origin of the animals being inspected at any particular time.

The conclusions of a non-blind, non-controlled epidemiologic experiment such as this must be viewed with caution. Obtaining and analyzing data for the alternative blind, controlled experiment would not have involved much extra effort since the meat inspection data already refer to individual herds.

Regional Surveillance for SEP Problem Herds*

Disease prevalence data for herds within the individual slaughterhouse can be used in a local surveillance program for problem herds as the basis for intensive follow-up, detailed epidemiologic analyses, or control efforts by local practicing veterinarians. A decentralized approach enables fair comparisons among local herds, it allows for additional input from the local veterinarians, and it avoids confounding due to differences among slaughterhouses.

The most important factor to assess in a herd-to-herd comparison is the size of the herds. Many endemic diseases such as SEP are influenced by the herd size—the larger the herd, the higher the disease rate. The size of bacon pig herds can be conveniently measured by the number of swine slaughtered per year, on which the data bank can give accurate information. Therefore, local comparisons of prevalence rates can easily be made within groups of similarly sized herds. Figure 2 shows the outcome of a data screening for SEP problem herds, which were defined as herds having significantly higher SEP prevalence rates than the herd-size-specific mean rate for the slaughterhouse and year in question. As can be seen, there was a large proportion of herds which were classified as SEP problem herds, but there was also a large proportion with significantly less SEP than the average.

The example shown in Figure 2 is from a current feasibility study using historical data.* The method can, of course, be applied to other diseases as well as being used with different definitions of problem herds based on prevalence rates at slaughter.

A Case-Control Study of Herd Factors as Determinants of SEP Problems[9]

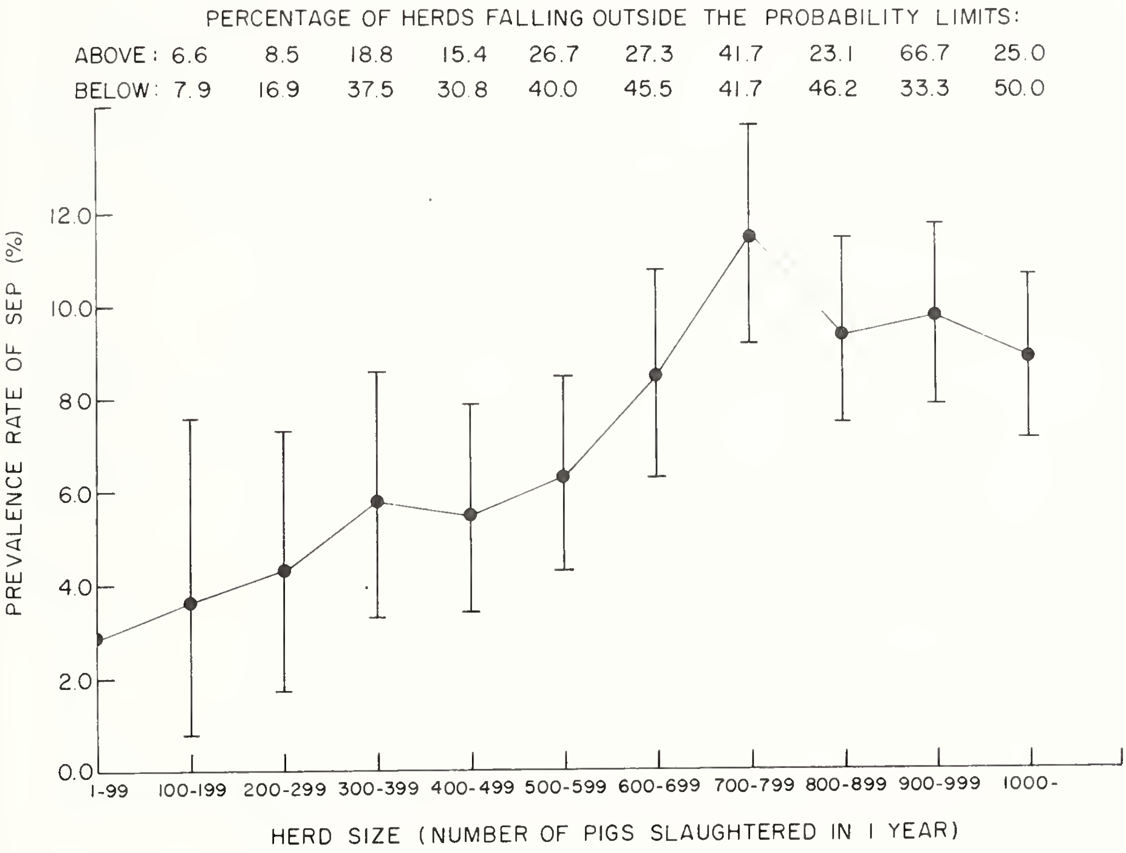
The design of choice for an epidemiologic follow-up study to a screening procedure as described above might very likely be a case-control study in which a series of identified problem herds is compared to a series of non-problem herds with respect to the presence of causal or disease-enhancing factors.

The analysis of case-control data consists in principle of calculation of odds-ratios or approximate relative-risk values (R) and chi-square (X^2) values based on the number of observations in 2 X 2 tables containing cases (problem herds) and controls (non-problem herds), respectively, by two contrasting levels of the factor under investigation.[10]

In 1971, a questionnaire survey was made in a sample of the herds from which the data in Figure 2 originated; the aim was to determine if certain housing or management factors were associated with high prevalence of SEP at slaughter. The data were compiled according to the case-control design,

*Reports on various aspects of this work are currently being prepared for publication by the author of this presentation.

FIGURE 2. Surveillance for Swine Enzootic Pneumonia (SEP) among Herds at a Danish Slaughterhouse through Screening of All Herds against the Herd-Size-Specific Average Prevalence Rate for the Period (1969). The proportions of herds which had prevalence rates above and below the ninety-five percent probability limits are indicated at the top of the figure. No comparisons were made for the smallest herd size interval due to the expected random variation in the disease rate in small herds.



herds with a three-year average SEP rate of five percent or more being the cases and herds with lower prevalence rates being the controls. Examples of the data are shown in Table 2 to illustrate the analytical technique and the implications of the results.

Herd size showed a significant association with the occurrence of SEP problems, which of course would be expected from the evidence shown in Figure 2.

Herd size was, however, associated not only with occurrence of problems, but also with the prevalence of other possible disease determinants such as type of ventilation system, purchase of weanlings vs. own production, etc. Therefore, a correct evaluation of the importance of the latter

TABLE 2. Relative Risk Analysis of Determinants of Swine Enzootic Pneumonia (SEP) in Herds from a Danish Slaughterhouse.+

Factor/Category	Number of herds: Cases (≥5% SEP)	Number of herds: Controls (<5% SEP)	Estimated relative risk (i.e. odds ratio): Crude	Estimated relative risk (i.e. odds ratio): Adj. for herd size
HERD SIZE				
<400 pigs slaughtered/yr.	49	111	1.0	—
≥400 pigs slaughtered/yr.	67	22	6.9**	—
VENTILATION				
No-fan system	25	60	1.0	1.0
Fan system	91	73	3.0**	1.8 n.s.
REPLACEMENT				
On-farm weaning	12	61	1.0	1.0
Purchase of weaners	104	72	7.3**	5.1**
DIARRHEA				
No infectious diarrhea	56	86	1.0	1.0
Infectious diarrhea	60	47	2.0*	1.5 n.s.
FREQ. OF OTHER DISEASES				
<3% prevalence at slaughter	55	85	1.0	1.0
≥3% prevalence at slaughter	61	48	2.0*	1.9*
TOTAL NUMBER OF HERDS	116	133		

+Previously published results were based on a subset of these data.[12]

n.s. Non-significantly different from 1, $p > 0.05$.

*Significantly different from 1, $p < 0.05$.

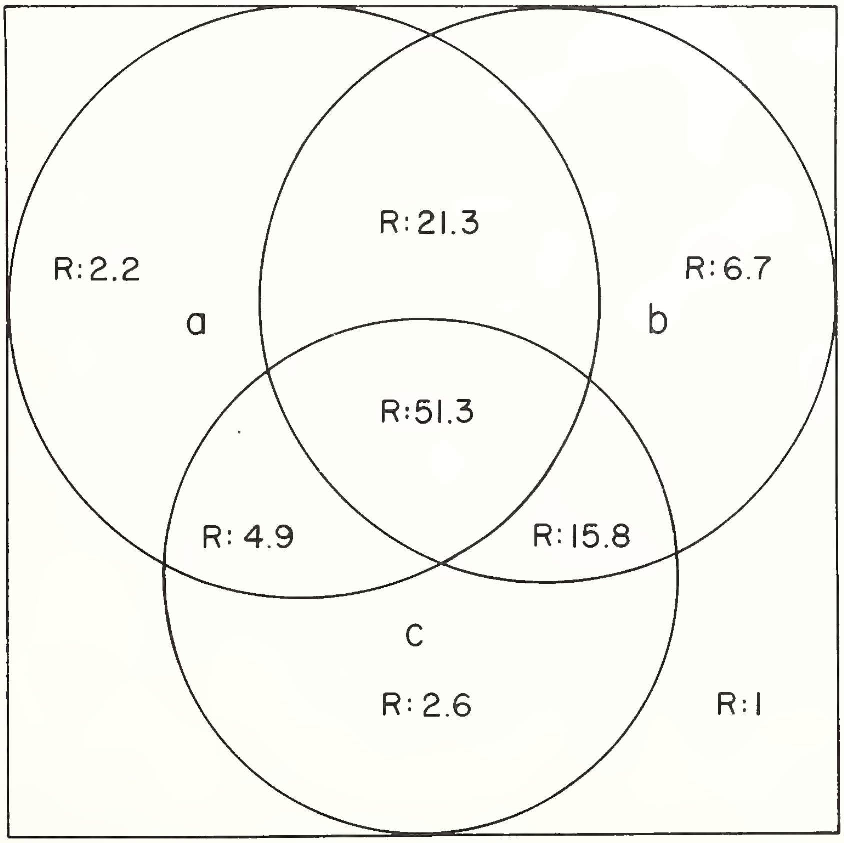
**Significantly different from 1, $p < 0.001$.

factors with respect to disease occurrence can only be made after adjustment for the confounding effect of herd size.[11]

Consequently, adjustment for the effects of herd size changed the risk of SEP problems for several factors, e.g. ventilation with fan relative to ventilation without fan. From a crude odds-ratio of 3.0 which was strongly significant based on a crude X^2-test, the adjustment changed the relative-risk estimate to a non-significant 1.8 (Table 2). Thus, the apparent effect of ventilation system on the disease occurrence was mainly due to the confounding effect of herd size.

The data were also analyzed for the interaction effects which may occur when several disease determinants are present in various combinations among the herds. Figure 3 contains the relative risk of SEP problems among herds simultaneously exposed to some of the factors given in Table 2; the results show how multifactorial disease-risk can build up through interactions among disease-enhancing factors.

FIGURE 3. Estimated Relative Risk (R) of Prevalence of Swine Enzootic Pneumonia at Slaughter above Five Percent for Herds Exposed to Combinations of Three Apparent Disease Determinants (cf. Table 2): a = ventilation with fans; b = purchase of weanlings; c = ≥3% prevalence at slaughter of other diseases.



Individual Clinical History and SEP at Slaughter[13]

The routine reporting of all slaughter inspection findings for a particular herd has been very useful for the herd managers. Surveillance of the herd's health condition benefits from the immediate feedback through the data bank. Additional advantages become available if individual animal identification is being established. Possible health implications of different medication, feeding, genetic background, etc. can then be evaluated by comparing prevalence rates at slaughter among simultaneously raised groups of swine.[14]

Even without such a prospective design, similar evaluations may be achieved. If all individuals in the herd have had their history carefully recorded throughout their lives, these data can be used to assign individuals to groups according to common exposures or other factors which may be analyzed for their association with the lesions found at slaughter (a "retrospective cohort study").

In a large Danish experimental farm, common pig housing systems were evaluated over a period of several years. The pigs were individually marked, weighed at intervals, observed, and treated for common diseases. Meat inspection findings were subsequently matched with the individual pig's record. The total file, covering 4,576 pigs, was processed for epidemiological analyses especially concerning associations between clinical disease and evidence of SEP at slaughter; some of the results appear in Table 3.

As all clinical SEP cases were treated, it was not possible to evaluate the efficacy of treatment versus no treatment, but it could be estimated how the results of the treatment strategy compared to a successful prevention, e.g. based on the SPF program.

Among all the 4,576 pigs, 8.7 percent had been treated for clinical episodes of SEP; 65 percent of those, or 5.7 percent of all pigs, had no lesions at slaughter, i.e. a recovery rate of 65 percent. A 100 percent effective treatment might thus have saved an additional 0.7 percent of the pigs from dying and 2.3 percent from chronic SEP lesions.

Compared to the available treatment program, an efficient SEP prevention program would have spared an additional 1.4 percent of the cohort from dying and 9.4 percent from chronic lesions. It can also be seen from Table 3 that lesions were detected in 26.9 percent of prior clinical cases compared to 7.8 percent among clinically normal pigs, which supports the validity of the routine diagnostic data from the slaughter inspection program.

DISCUSSION

Epidemiologists rarely have the opportunity to analyze diagnostic data

TABLE 3. TABLE 3. Occurrence and Outcome of Swine Enzootic Pneumonia (SEP) in a Danish Bacon Pig Herd[15]

Disease outcome	Clinical SEP			No clinical SEP			All pigs	
	No. of pigs	% of clinical cases	% of all pigs	No. of pigs	% of non-cases	% of all pigs	No. of pigs	% of all pigs
Mortality due to SEP	30	7.5	0.7	33	0.8	0.7	63	1.4
SEP lesions at slaughter	107	26.9	2.3	324	7.8	7.1	431	9.4**
No SEP lesions*	261	65.6	5.7	3,821	91.5	83.5	4,082	89.2
TOTAL	398	100.0	8.7	4,178	100.0	91.3	4,576	100.0

*Includes slaughtered pigs without SEP as well as pigs dying from other diseases.

**Equivalent to 9.8 percent of pigs slaughtered.

from routine screening of each individual in a national population, but the Danish Swine Slaughter Inspection Data Bank does provide that type of information. This allows for a wide range of sampling designs to suit linkage with other data, analysis of determinants as well as outcomes of disease, different population levels, etc.

Since the primary aim of the diagnostic screening is to secure the wholesomeness of the pork for consumption, the available data are limited to diseases which give rise to a sufficiently grave type of lesion to warrant local or total condemnation. This places definite limitations on the number and variety of swine diseases to be investigated through this source of information. Many economically important conditions, however, are covered by the comprehensive and inexpensive diagnostic data which appear to be specific enough to give valid epidemiological results.

The Danish Swine Slaughter Inspection Data Bank makes its information available relating to the most relevant units—the herds of origin. Different marketing patterns make similar systems difficult to establish in many other countries. New technological developments, e.g. in electronic identification of animals, may allow such nations in the future to make full use of their slaughter inspection data in animal disease campaigns on all population levels.[16]

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THE LABORATORY ANIMAL DATA BANK (LADB)

Fritz P. Gluckstein,
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Warren G. Hoag*

The Laboratory Animal Data Bank (LADB) is an online interactive computer system providing unpublished comparative data on hematology, clinical chemistry, histopathology, husbandry, and environment of animals used as experiment controls at research and testing institutions. It also contains descriptive data, such as origin, characteristics, and location of various animal strains. The system will be available through a nationwide telecommunication (telephone) network early in 1979.

LADB is sponsored by the National Cancer Institute, the National Center for Toxicological Research, the National Library of Medicine, the Department of Health, Education, and Welfare Committee to Coordinate Toxicology and Related Programs, and the Interagency Regulatory Liaison Group (Consumer Product Safety Commission, Environmental Protection Agency, Food and Drug Administration, and Occupational Safety and Health Administration).

LADB has been developed and is currently maintained and operated under contract by Battelle Columbus Laboratories. The National Library of Medicine, with the guidance of a task group of scientists from various government health agencies, monitors the data bank. It is planned that quality control of data will be maintained by the Federation of American Societies for Experimental Biology, which would develop and review data element descriptors and data collection criteria and standards through panels of experts. A proposed data review panel representing various scientific disciplines would review all incoming data regularly to assure that they meet LADB's acceptance criteria. Consultants representing organizations such as the Committee on Standardized Nomenclature for Inbred Strains of Mice will provide advice on animal nomenclature and genetics information. Periodic comprehensive evaluations of LADB's data, operation, and development are conducted by the National Academy of Sciences through its Institute of Laboratory Animal Resources.

The major objectives of LADB are (1) to assist researchers in selecting the best breed or strain of laboratory animal for a particular biomedical

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experiment; (2) to provide comparisons of laboratory data with consideration of variables in breed or strain, origin, sex, age, environmental factors, husbandry factors, and test methods; (3) to establish accurate baseline values considering the above variables; (4) to determine factors which may affect test results; (5) to determine frequency of spontaneous diseases and pathologic changes considering the variables listed above; and (6) to assist in designing experiment protocols that are economical of animal use, manpower, and equipment.

SEARCH MODES

LADB permits the use of two search modes: a structured (menu oriented) and a direct (command oriented) mode.

Structured Search Mode. This mode is designed for scientists with little or no experience with online retrieval systems. It will guide the user step by step toward the retrieval of data and through their statistical analysis (Figure 1). No formal training in computer retrieval methodology is necessary to use the structured search mode.

Direct Search Mode. The direct search mode is for users familiar with searching data bases and requires formal training in the application of a specialized command language. It is faster and more versatile than the structured mode.

DATA FILES

LADB is designed to contain five data files. One of these contains summarized numeric baseline animal data, while the other four are descriptor files.

Baseline File

Animal Groups. The Baseline File contains summarized data on animal groups. LADB defines an animal group as a group of animals of the same breed or strain, with the same user (institution or laboratory) and the same supplier (breeder), kept under the same environmental and husbandry conditions. All hematology and clinical chemistry data summaries are based on individual animal data collected by LADB. Presummarized data will not be accepted. Individual animal data are retrievable through offline searches and printouts.

Control Animals. Baseline data are derived from negative and sham controls. Negative or unmanipulated controls are animals that are not being experimentally manipulated other than for the purpose of establishing

FIGURE 1. Structured Search Mode "Menus"

```
CHOOSE SPECIES BY NUMBER:

  1.  CAT (DOMESTIC SHORT HAIR)
  2.  DOG (BEAGLE ONLY)
  3.  HAMSTER (SYRIAN GOLDEN ONLY)
  4.  MINIPIG
  5.  MONKEY
  6.  MOUSE
  7.  RABBIT
  8.  RAT
  9.  TUPAIA
 10.  RETURN TO "CHOOSE FILE"
    / 6

CHOOSE MOUSE STRAIN(S) BY NUMBER:

  1.  ALL
  2.  BALB/C
  3.  B6C3F1
  4.  CB6F1
  5.  CD2F1 BR
  6.  C3H/HE
  7.  C57BL/6
  8.  ICR/HAM
  9.  ICR/MBR (AVAILABLE SOON)
 10.  NIH SWISS
 11.  SWISS ALBINO
 12.  SWISS WEBSTER
 13.  RETURN TO "CHOOSE SPECIES"
   / 3
```

normal baseline values by accepted clinical methods. Sham controls are being handled in the same manner as experimental animals (same restraint, same vehicle administration, etc.) except for the definite experimental procedure.

Data Groupings. Baseline data are stored in such a manner that an animal group is represented by a description of that group consisting of group identifiers and environmental and husbandry factors (Figure 2) and by summarized hematology and clinical chemistry data arranged by combinations of sex, age, and test (observation) year for each data element (RBC, HCT, BUN, etc.) within the group. The data can be printed out as tabular reports (Figure 3).

Information on test methods and equipment used to determine baseline values (e.g. Coulter Cell Counter Model A; Hexokinase Method using Gilford 3400) can also be retrieved.

FIGURE 2. Baseline File. Animal Group Description

ITEM 6

SPECIES	:	DOG
TYPE OF BREEDING	:	OUTBRED
PREFERRED NAME	:	BEAGLE
GROUP NUMBER	:	00009
MICROBIAL STATUS	:	CONVENTIONAL
TYPE OF CONTROL USED	:	NEGATIVE CONTROLS
DATA SOURCE NAME	:	BATTELLE COLUMBUS LABORATORIES
DATA SOURCE CITY	:	COLUMBUS
DATA SOURCE STATE	:	OHIO
SOURCE LOCATION ALTITUDE	:	780 FEET
SOURCE LOCATION LATITUDE (N)	:	40 NORTH DEGREES
ANIMAL SUPPLY SOURCE	:	HAZLETON
SUPPLIER HOUSING TYPE	:	NS
HOUSING LIGHTING TYPE	:	FLUORESCENT
HOUSING LIGHTING SCHEDULE	:	CONTROLLED
DAILY CNTRLED EXPOSURE HOURS	:	12
FEED COMMERCIAL BRAND	:	PURINA DOG MEAL
FEED MANUFACTURER OR SUPPLIER	:	RALSTON PURINA
FEED CRUDE PROTEIN	:	27%
FEED CRUDE FAT	:	9%
BASAL DIET SUPPLEMENTED	:	NO
FEEDING FREQUENCY	:	DAILY
FEED METHOD	:	MEASURED
FEED TREATMENT BEFORE FEEDING	:	NONE
FEED FORM	:	PELLET
FEED CONTAINER	:	OPEN DISH

etc

FIGURE 3. Baseline File. Tabular Report of Hematology Data
N = Number of observations

GROUP NUMBER : 5

DATA ELEMENT	N	AVERAGE	STD DEV	UNITS
HEMATOCRIT	83	45.39	4.34	PERCENT
HEMOGLOBIN	83	15.15	1.31	GRAM-PERCENT
RED BLOOD CELL COUNT	83	5.89	0.57	*1000000/CU MM
WHITE BLOOD CELL COUNT	83	10.28	2.82	*1000/CU MM
DIFF. BAND NEUTROPHILS	70	0.81	1.55	PERCENT
DIFF. SEGMENTED NEUTROPHILS	82	63.34	10.62	PERCENT
DIFF. LYMPHOCYTES	82	29.85	9.48	PERCENT
DIFF. MONOCYTES	82	1.91	2.09	PERCENT
DIFF. EOSINOPHILS	82	4.24	3.27	PERCENT
PLATELETS	83	300.05	119.80	*1000/CU MM
RETICULOCYTES	83	0.60	0.38	PERCENT/100 NRBC

Statistics. Summarized data (RBC, HCT, BUN, etc.) for each sex, age, and test year grouping within each animal group are reduced to sixteen class frequency distributions representing the actual data with a high degree of accuracy. These summarized data are the basis of LADB's statistical services. At present four such services are available: (1) distributions (summary statistics, frequency histograms (Figure 4), and frequency tables); (2) crosstabulation and chi-square test with measures of association; (3) breakdown (any combination of animal groups, sex, age, and test year); and (4) t test.

One-way analysis of variance and scatterplot with optional linear regression and correlation are being implemented.

A further service allowing a user to enter his own data and statistically compare them with those in the Baseline File is likewise being implemented.

Histopathology Data. Histopathology data, as those for hematology and clinical chemistry, are stored in a summarized manner. They are broken down by five identifiers: animal group, observation (test) year, age, sex, and manner of death (spontaneous or induced). Specific changes (lesions) are reported by combinations of these identifiers, by frequency in a specific organ (frequency by organ), and by frequency regardless of organ (frequency by animal) (Figure 5). Histopathology data for individual animals are available through offline searches and printouts.

Strain File

The Strain File consists of descriptive data on laboratory animal strains. It provides information on origin, characteristics (e.g. morphology, physiology, occurrence of diseases), and institutions where the strains are maintained (Figure 6). The file contains data on mice and rats, but data on other rodents, rabbits, and primates are being added. At present Strain File data are derived from the published literature; however, the inclusion of unpublished data and those in the prepublication stage is planned.

Husbandry File (to be implemented)

This file will describe standards of animal care as published by governmental agencies, professional groups, and scientific societies.

Protocol File (to be implemented)

The Protocol File will describe the standards of handling, diurnal conditioning, circadian rhythms, bleeding schedules, and other controlled interactions in animal groups.

FIGURE 4. Baseline File. Frequency Histogram of Red Blood Cell Data

```
SPSS/ONLINE V4.0
- - - FREQUENCIES - - -

END OF FILE ON FILE INDATA
AFTER READING    189 CASES FROM SUBFILE NONAME

RBC        RBC IN 10**6 PER CU MM

MEAN          6.631    STD ERR        .040    MEDIAN        6.626
MODE          6.320    STD DEV        .628    VARIANCE       .394
KURTOSIS      2.241    SKEWNESS       .421    RANGE         5.209
MINIMUM       4.640    MAXIMUM       9.849    SUM        1657.724
C.V. PCT      9.464    .95 C.I.      6.553            TO    6.709

VALID CASES     250     MISSING CASES     0
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

- - - FREQUENCIES - - -

RBC       RBC IN 10**6 PER CU MM


     CODE
          I
    4.640 ** (     1)
          I
          I
    4.987 * (     0)
          I
          I
    5.334 ***** (     8)
          I
          I
    5.682 ********* (    16)
          I
          I
    6.029 ******************** (    37)
          I
          I
    6.376 ************************** (    50)
          I
          I
    6.723 ****************************** (    59)
          I
          I
    7.071 ********************* (    40)
          I
          I
    7.418 ************** (    26)
          I
          I
    7.765 ***** (     7)
          I
          I
    8.112 **** (     5)
          I
          I
    8.460 * (     0)
          I
          I
    8.807 * (     0)
          I
          I
    9.154 * (     0)
          I
          I
    9.501 * (     0)
          I
          I
    9.849 ** (     1)
          I
          I
          I.........I.........I.........I.........I.........I
          0        20        40        60        80       100
          FREQUENCY

VALID CASES     250     MISSING CASES     0

SINCE MULTIPLE OBSERVATIONS ARE OFTEN OBTAINED FROM EACH ANIMAL
OVER TIME, THE STATISTICS ARE BASED ON THE NUMBER OF VALID
CASES  (OBSERVATIONS) SHOWN ABOVE OBTAINED FROM NOT MORE THAN 134
INDIVIDUAL ANIMALS.
```

FIGURE 5. Baseline File. Histopathology Data

ITEM 3

GROUP NUMBER	:	00021
OBSERVATION YEAR	:	1973
AGE CATEGORY	:	12
SEX	:	MALE
MANNER OF DEATH	:	INDUCED

RESPIRATORY TRACT

ORGAN	:	LUNG
MAJOR CHANGE	:	INFLAMMATION
SPECIFIC CHANGE	:	PNEUMONITIS
FREQUENCY BY ORGAN	:	1/6
FREQUENCY BY ANIMAL	:	1/6

ORGAN	:	LUNG
SPECIFIC SITE	:	PERIBRONCHIAL AREAS
MAJOR CHANGE	:	INFLAMMATION
SPECIFIC CHANGE	:	LYMPHOID INFILTRATION
INTENSITY	:	VERY MILD
FREQUENCY BY ORGAN	:	3/6
FREQUENCY BY ANIMAL	:	6/6

ORGAN	:	LUNG
SPECIFIC SITE	:	PERIBRONCHIAL AREAS
MAJOR CHANGE	:	INFLAMMATION
SPECIFIC CHANGE	:	LYMPHOID INFILTRATION
INTENSITY	:	MODERATE
FREQUENCY BY ORGAN	:	1/6
FREQUENCY BY ANIMAL	:	6/6

ORGAN	:	LUNG
SPECIFIC SITE	:	PERIBRONCHIAL AREAS
MAJOR CHANGE	:	INFLAMMATION
SPECIFIC CHANGE	:	LYMPHOID INFILTRATION
INTENSITY	:	MILD
FREQUENCY BY ORGAN	:	2/6
FREQUENCY BY ANIMAL	:	6/6

FIGURE 6. Strain File. Strain Description

ITEM 1

SPECIES : RAT
TYPE OF BREEDING : INBRED
PREFERRED NAME : ALB
SYNONYM : ALBANY;
ORIGIN : TO N 1951 FROM WOLFE AND
WRIGHT AT F?. NO INBREEDIND RECORDS PRIOR TO TRANSFER TO
N, BROTHER-SISTER MATED SINCE THEN ;
INBRED GENERATIONS : (48) 61 ;
GENETICS : A/A ; B/B ; C/C ; H/H ;
AG-AA ; AG-B6 ; AG-C2 ; NOT AG-DX1 ;
CHARACTERISTICS : NON AGOUTI BROWN ; MAMMARY
FIBROADENOMA ; VARIABLE FREQUENCY OF FETAL RESORPTION
WHICH AFFECTS REPRODUCTIVE PERFORMANCE ; DOCILE BEHAVIOR ;
SYSTOLIC BLOOD PRESSURE OF MALES AT 10 WEEKS OF AGE, 143
MM. HG ;
MAINTAINED BY : NIH ;
REFERENCE SOURCE : NIH CATALOGUE

Analytical Procedures File (to be implemented)

This file will describe the accepted methods for measuring baseline variables (standards, materials, instrumentation, etc.).

FUTURE DEVELOPMENT

Various improvements and developments are planned for LADB, the major ones of which are the following:

1. A search mode intermediate between the structured and direct search modes.
2. Revision of the histopathology retrieval system including development of free text search capability and online individual animal data retrieval.
3. Online retrieval of hematologic and clinical chemistry data from individual animals.
4. Online user feedback of evaluations and problems encountered.
5. A human disease model system permitting searching by pathologic changes, signs, and symptoms rather than solely by human disease prototype.
6. Inclusion of data from animals serving as controls in interaction experiments (e.g. the effect of certain dietary substances on carcinogenicity).

THE FLORIDA VETERINARY CLINICAL DATA RETRIEVAL SYSTEM

M. J. Burridge and S. M. McCarthy*

The Veterinary Medical Data Program (VMDP) of the National Cancer Institute has been the major source of veterinary clinical data in North America. The VMDP was initiated in 1964 so that the National Cancer Institute could obtain retrospective animal cancer data in a standardized format for its research activities.[1] It started as a pilot study at the College of Veterinary Medicine of Michigan State University and thereafter expanded to involve other institutional veterinary medical facilities, including most of the veterinary schools in North America.[2]

The structure of the VMDP had several limitations primarily because of adherence to an eighty-column format suitable for data entry through punch cards. The new College of Veterinary Medicine at the University of Florida wished to make maximal use of its clinical data for research, teaching, and administrative purposes. That necessitated retrieval of much more data than was possible using the VMDP format. Therefore, a computerized system capable of handling detailed data on both clinical and laboratory procedures was designed. This report gives a description of the veterinary clinical data retrieval system developed at the University of Florida.

DESCRIPTION OF RETRIEVAL SYSTEM

Data Entered

Medical records are established for every patient seen at the University of Florida Veterinary Medical Teaching Hospital. The following data are transcribed from each record onto a Veterinary Medical Case Abstract form (Figure 1) for subsequent entry into the retrieval system:

- Patient number
- Referral status
- Ownership status (privately owned or discharged to research)
- Species
- Breed

---

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FIGURE 1. Veterinary Medical Case Abstract Form Used for Entry of Data into the Florida Veterinary Clinical Data Retrieval System

INSTITUTION
1 9
1 2

PATIENT NUMBER
Box 3 Enter 1 if referral, otherwise enter 0.
Box 4-9 Enter patient No.
Box 10: Enter R if patient discharged to research, otherwise leave blank
3 4 5 6 7 8 9 10

GEOGRAPHICAL LOCATION
(Use Zip Code)
11 12 13 14 15

ATTENDING CLINICIAN
(Use code)
16 17 18

ENTRY DATE
Mo. Day Year
19 20 21 22 23 24

DISCHARGE DATE
Mo Day Year
25 26 27 28 29 30

DISCHARGE STATUS
0=Alive (case terminated)
1=Alive (on-going case)
2=Dead (necropsy)
3=Dead (no necropsy)
4=Euthanasia (necropsy)
5=Euthanasia (no necropsy)
6=Discharged to research
31

SPECIES
(Use Code)
32 33

BREED
(Use Code)
34 35 36

SEX
0=Litter
1=Female
2=Female spay
3=Female unknown
4=Male
5=Male castrate
6=Male unknown
7=Unknown
37

WEIGHT
(In Kgs.)
38 39 40 41

AGE
Exact or Inexact
Years weeks
42 43 44 45
0=Infant
1=Juvenile
2=Adult
3=Aged
46

FIRST DIAGNOSIS 47 0=Initial 1=Final (Use Code) 48 49 50 51 52 53 54 55 56

SECOND DIAGNOSIS 57 0=Initial 1=Final (Use Code) 58 59 60 61 62 63 64 65 66

THIRD DIAGNOSIS 67 0=Initial 1=Final (Use Code) 68 69 70 71 72 73 74 75 76

FIRST OPERATION (Use Code) 77 78 79 80 81

SECOND OPERATION (Use Code) 82 83 84 85 86

DIAGNOSTIC PROCEDURES (check appropriate boxes)

87 Physical Diagnosis ONLY
88 Necropsy
89 Histopathology
90 Immunology
91 Microbiology
92 Radiology
93 Cardiology
Circle forms completed: C_1, C_2
94 Hematology
95 Urinalysis
96 Clinical Chemistry
97 Parasitology
98 Ophthalmology
Circle forms completed: Op_1, Op_2, Op_3
99 Neurology
Circle forms completed: N_1, N_2, N_3, N_4, N_5
100 Toxicology
101 Other

NON-DIAGNOSTIC CASE
102
0—Not applicable
1—Total exam—normal
2—Bone & joint exam—normal
3—Sensory organs exam—normal
4—Reproductive exam—normal
5—Cardio vascular exam—normal
6—Integumentary exam—normal
7—Other exam—normal
8—Biologic donor
9—Other (boarder, etc.)

COAT COLOR
(Use Code)
103 104

Comments

VETERINARY MEDICAL CASE ABSTRACT

VMTH—T11—7/77

Sex
Age (two mutually exclusive categories for exact and inexact age)
Weight
Coat color
Location of residence (by zip code)
Attending clinician
Entry date
Discharge date
Discharge status
Diagnoses (indicating whether or not confirmed)
Diagnistic procedures used
Operations performed
Data on non-diagnostic cases (normal examinations, etc.)

All diagnoses and operations are coded using the *Standard Nomenclature of Veterinary Diseases and Operations* (SNVDO).[3]

The data on each Case Abstract form, together with data on diagnostic procedures used, are entered into the data base through a remote terminal. A summary of the data on diagnostic procedures that are entered into the retrieval system is given in Table 1.

TABLE 1. Summary of Data on Diagnostic Procedures Entered into Florida Veterinary Clinical Data Retrieval System

Diagnostic procedure	Number of variables entered	
	Qualitative*	Quantitative+
Histopathology	15	0
Immunology	20	0
Microbiology	25	0
Radiology	38	0
Cardiology	13	27
Hematology	2	30
Urinalysis	2	27
Clinical chemistry	16	63
Parasitology	10	0
Ophthalmology	19	0
Neurology	15	12
Toxicology	12	28

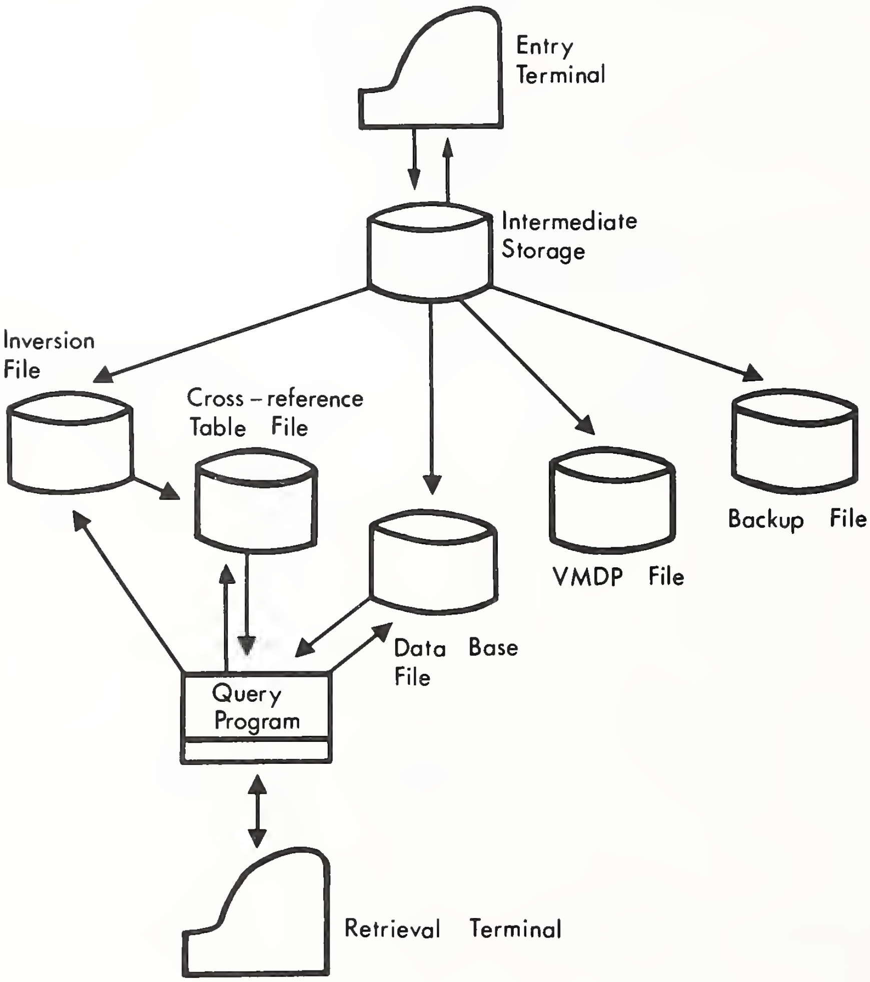
*Number of individual diagnostic techniques recorded only as done or not done

+Number of individual diagnostic techniques recorded as exact value of result

Data Entry, Storage, and Retrieval

The data entry, data extraction, and query-retrieval programs are shown diagrammatically in the form of a flowchart in Figure 2. All programs are written in COBOL (Common Business Oriented Language). The entry program contains numerous checks to minimize the possibility of entry errors. If unacceptable data are entered, the nature and location of each error is displayed on the terminal screen so that it can be corrected immediately.

FIGURE 2. General Flowchart of Florida Veterinary Clinical Data Retrieval System



Data on each medical record are entered through a terminal into intermediate storage in an Amdahl 470 computer. Records remain in intermediate storage if they are incomplete. Once completed, all records are stored in four files: a data base file, a virtual storage access method (VSAM) inversion file, a VMDP file, and a backup file. The data base and VSAM inversion files are relative, allowing random access to designated blocks of data, whereas the VMDP and backup files are sequential, necessitating serial processing of all records in each file. The VMDP file contains records transposed into the VMDP format so that University of Florida data can be entered into the national veterinary clinical data base.

The storage of medical records in such a network data base permits a variable amount of data to be associated with each unique patient number. Key cross-reference points within each record are stored in a VSAM inversion file. When a query is made, a range of key cross-reference points is specified and a series of relational tables is built from the VSAM inversion file. Particular fields from within the related records may then be printed at the terminal without having to print entire medical records.

Data are retrieved from the system by entering commands and parameters to those commands through a terminal. The basic input format for a query is

XREF

parameter-1 = a THRU b

parameter-2 = c THRU d

parameter-3 = e THRU f

END-XREF

LIST

parameter-4

parameter-5

END-LIST

XREF is the command to build an internal table of those medical records that have fields corresponding to the parameter values specified by the user. END-XREF is the command that signals the end of the first parameter list and the commencement of construction of internal tables. LIST is the command to print the values of the parameters specified by the user in the second parameter list. END-LIST is the command that signals the end of the second parameter list and the commencement of printing. The parameters to either the XREF or LIST command can be any number of the following: patient number, species, breed, sex, exact age, inexact age, weight, coat color, location of residence, attending clinician, entry date, discharge date, discharge status, diagnosis (by either the topographical or the etiological part of the SNVDO code), diagnostic procedure, operation (by either the topographical or the procedural part of the SNVDO code), and non-diagnostic case. The "THRU b" part of each parameter line is optional and is used to specify a range of values which pertain to the cross-reference. The output is printed in tabular form with each vertical

column giving the values of the individual parameters specified after the LIST command.

DISCUSSION

The retrieval capabilities of the Florida Veterinary Clinical Data Retrieval System are far greater than those of the VMDP. This is due, in part, to improvements in both the quality and the quantity of data entered. The major improvements include the following:

1. The overlapping age ranges of the VMDP have been replaced by two mutually exclusive categories, one for exact age and one for inexact age. These changes allow full utilization of exact age data and obviate the necessity for guessing or estimating the ages of the other patients. Hence the accuracy of both analysis and interpretation of age data is enhanced.

2. The overlapping weight ranges of the VMDP have been replaced by a field for entry of exact weights, similarly allowing full utilization of weight data.

3. The location of residence (by zip code) and the coat color of each patient have been added to the data entered into the Florida System. These additions permit epidemiological and environmental studies that were impossible with VMDP data.

4. Other diagnostic procedures (immunology, cardiology, ophthalmology, neurology, and toxicology) have been added to those already considered by the VMDP.

5. Detailed qualitative and quantitative data on twelve diagnostic procedures (Table 1) have been entered into the Florida System; in contrast, no laboratory data were included in the VMDP. These inclusions add a new dimension to the Florida System by allowing retrieval of data on individual laboratory tests or techniques.

6. Information on the referral and ownership status of each patient has been appended to the Florida patient number as an aid to hospital administration.

These improvements add greatly to the applicability, versatility, and overall value of the Florida Veterinary Clinical Data Retrieval System. Consequently, veterinarians from a wider variety of disciplines are becoming interested in data retrieval and analysis which in turn improves the quality of the data input.

The incorporation of advanced computer software technology in the Florida retrieval program has resulted in both increased retrieval efficiency and reduced retrieval costs. The use of relational mapping with a VSAM

inversion file allows the retrieval program to gain direct access to the small number of medical records which meet the specified cross-reference criteria, thus avoiding a lengthy sequential search of all records in the data base.

The Florida Retrieval System was designed for use in research, teaching, and administration. The software was developed to minimize the possibility of entry errors, to maximize efficiency of data storage and retrieval, and to allow easy modification of existing programs. Such modifications will doubtless become necessary as experience indicates limitations in the programs or as new data become available for inclusion in the System. With this level of sophistication, efficiency, and flexibility, it is hoped that the Florida Veterinary Clinical Data Retrieval System may serve as a model for the development of similar systems at other veterinary medical institutions.

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CONSENSUS FROM THE DISCUSSION OF THE PAPERS PRESENTED IN THE EPIDEMIOLOGICAL INFORMATION AND LABORATORY AND CLINICAL DATA SECTIONS

A panel of three, Dr. Winthrop Ray, Brucellosis Epidemiologist, Cattle Diseases Staff, Veterinary Services, APHIS, USDA, Dr. Waldo Keller, Chief of Brucellosis Planning, Health of Animals Branch, Agriculture Canada, and Dr. Calvin Campbell, USDA Epidemiologist for Brucellosis in New Mexico, provided the following comment on the foregoing papers.

This gathering serves as yet another chapter in the progressive series of international symposia that have served to maintain an international awareness of the developments in this specialized field. It was preceded by the Symposium on Animal Disease Monitoring at the University of Guelph, Ontario, Canada, in 1974, that on New Techniques in Veterinary Epidemiology and Economics in Reading, England, in 1976, and the International Summer School on Computers and Research in Animal Nutrition and Veterinary Medicine in 1972 at Elsinore, Denmark. Already there are tentative plans for a subsequent symposium in Australia in April/May of next year.

Although this session will soon progress to a more detailed examination of the systems already described, we can build a framework on which to base later discussion if first we examine the presentation as a unit.

The systems lend themselves to a categorization of at least three phases:

(1) *The geographic or population scope of the program.* We see a definite hierarchy of applications, from the international aspect of FAO to the very intimate veterinary practitioner/farmer relationship of the Minnesota system, with national systems such as the United Kingdom's in between.

(2) From a regulatory viewpoint we note *two definite phases* in these systems. We note the *intrinsic* phase, in which we are in full control of data accumulation and reporting, as in the meat inspection systems. Similarly we note the *extrinsic* phase, such as in the Minnesota program, where much of the control, of necessity, is left to the non-regulatory participants.

(3) We recognize *two major approaches.* The *active* approach, with its ensuing cost consideration, can be contrasted to the *passive* United Kingdom approach which makes better use of existing data sources.

If the systems can be so differentiated they can be similarly combined in

regard to their common problems and objectives:

(1) *Money*. As cited in the Minnesota system, all programs are subject to the cost-benefit aspects which are infringing on the approach used in the avian disease systems.

(2) *Nomenclature*. As cited in the avian disease systems, when you congregate a group of free-thinking professionals and infer a standardized terminology it is difficult to reach an agreement.

(3) Without investing in an active system of data retrieval (such as in Minnesota) you are hard pressed to insure that your *information is representative of the population at risk*.

(4) *Data validity* is subject to increasing scrutiny as you progress to the more extrinsic phase of the systems. The control you lose over diagnosis has to be taken into consideration in the evaluation of the data.

(5) *Recognition of data limitation* could describe the self-assessment necessary prior to presenting statistics based on our collected data. FAO is to be commended for a logical semi-qualitative approach to disease incidence in recognition of the varied accuracy of its information.

(6) *Freedom of information* has become a sensitive aspect of data processing in North America in recent years. If you gather production-related parameters on a per farm basis you are assessing the owner's net worth, an estimable invasion of privacy. Such consideration could represent a definite obstacle to a centralized individual farm identification in Canada and the United States, with the loss of the advantages that could be derived as evidenced in Australia.

(7) *Buyer resistance*, particularly by field personnel, is a common factor to any EDP program and serves to delineate the routes we take in establishing the reporting systems, in attempting to achieve the optimum format for field entry and data processing. Not to be forgotten is the potential inertia of upper management in regard to new systems.

Similarly, these systems can all be grouped as courageous inroads, in spite of the besetting problems, into the very applications that new EDP practical technology facilitates, using as much current information as is available (geographical, etc.) while showing no scope limitation (for instance wildlife data). Their common goal is to give government and industry meaningful data on which to approach animal health and disease in the business-like fashion modern agriculture demands.

DISCUSSION

The panel's discussion on epidemiology, laboratory and clinical data has

placed in perspective the state of the art. This is a complicated and multifacted field in which no single individual or system is going to be capable of achieving the requirements of providing the correct information to the food animal producer for the control of animal disease. It is going to require the cooperation of many facets of the knowledge presented at this and similar symposia to produce this information.

Papers were presented describing how the various levels of disease recording were being handled: from the extremes of international disease reporting to disease reporting at the farm level; from systems that record basic data about species of animals to systems that record specific diseases in a species of animal.

What were the results? It appears obvious that computer oriented programs of disease recording will not be of assistance in international disease recording for quite some time mainly because

(1) they are not in sufficient use in most countries to make meaningful input;

(2) more importantly, the methods of international reporting which were explained by Dr. Königshöfer have a different implication than a disease control program of a particular country;

(3) further, the diseases considered important internationally may not exist in many countries.

This raises a question: How does a country determine its disease status? In the context of this symposium papers were presented that described how some countries were doing this. It was suggested by many speakers that a computer recorded data base is possible which will handle the massive volume of data that are being produced from the many available sources. What should be done with the data? To answer this question one must look at the following questions:

(1) How valid or how accurate are the data?
(2) Who provided the data?
(3) What was his incentive to provide the data?

The answers to these questions will go a long way toward fulfilling the requirements of an efficient and adequate disease recording system. This was highlighted by Dr. Davies from the United Kingdom Ministry of Agriculture, Fisheries and Food. For the system to be efficient and accurate it must be used, and conversely must be capable of being used by the persons who provide the data for it. That is, a disease recording system to be effective must provide feedback to the animal producer who, seeing the benefit thus provided, will take greater care to produce accurate data. The example of the animal producer is equally applicable to the user of any discipline that provides raw data for a system, e.g. laboratory animal data systems. Once the information provided can be validated and is of an acceptable quality, it will be possible for the others interested in it to organize it, by use of programs in the computer system, to produce the

reports that they need to indicate progress of the control or eradication programs.

The dynamics of the technology: During discussion we were told that in the commercial field experience has shown what is possible and important today will have altered in the short space of three years. Considering the variables that occur in biology it is fairly obvious to us that the system must be versatile. It should have programs built in to allow for the possible changes of the future. If it is not capable of this, the system will fail through lack of use. It will no longer provide the user with the information he needs.

The volume of data available: Should all information be used (disease information from post mortem slaughter data, data of disease diagnosis at laboratories)?

The discussion suggested that while this information does contain certain biases if used in association with specifically designed field surveys, it will provide a good monitoring of the disease status of a country. Because of other constraints such as cost it is not a tool that can be used at will. Further, with the equipment and technology available today it is possible to make more use of the existing data than was possible before the computer age. It was highlighted that the only real limitation on such equipment and systems is what the user expects to obtain from the system. It is important to realize that the system is capable of meeting the user's expectations.

In closing I would like to thank the speakers, some of whom have travelled a long way to be present. Further, I would like to thank all of you for participating and making this symposium what it has been. Although these systems have been discussed from a user's point of view, it was not possible to have discussion on how the principles involved can be made accessible to any particular country interested in obtaining details of the operation. The publication of the proceedings of this and other symposia should go a long way toward dissemination of this information.

David J. Matthews,
Chairperson,
Epidemiological Information

SECTION IV

RESEARCH IN PROGRESS INFORMATION SYSTEMS

David F. Hersey,
Chairperson

INTRODUCTION

There are, to the best of my knowledge, no data bases about research in progress which are devoted exclusively to animal health and disease. Instead there are data bases either in the field of agriculture or in still broader areas covering all fields of science which contain within them varying amounts of information relating to animal health and disease.

It is virtually impossible to estimate at this time the number of data bases of this type actually in existence which may contain information that would be useful to research and development managers, investigators, or policy makers. In addition, there is the broad multidisciplinary nature of the field itself which suggests that information germane to it may well be found in data bases which are not primarily agriculturally oriented at all. I am referring here to systems that deal with subject areas which may be peripheral or tangential to those described in the symposium. They might include, for example, data base file accumulations dealing specifically with food and nutrition, environmental or occupational safety, and health research.

It is my intent here to mention some of these other systems and data bases and a source to identify still others which have not been described by speakers at the symposium in order that you might be aware of them for future reference. The importance of a knowledge of ongoing research information and the value which can be attached to it have already been amply documented in the literature.[1] Information about research in progress, like information of any other type, should not be thought of as just a separate entity although, like information from other sources, it clearly can and does meet specific needs of certain users and may independently meet their requirements. On the whole, however, it should be considered as only one part of a larger armamentarium of information resources which can be utilized in support of research and development, planning and management, and yes, even policy making at the national, regional, or international level.

Because of the multidisciplinary nature of research today, which I mentioned earlier, we must have a much greater knowledge of information today in many fields beyond that which in earlier years might have been referred to as our own narrow area of interest. I should like to use as an illustrative example a major topic of current worldwide interest and importance, namely food and nutrition. Many of you may already be familiar with the recent study by the National Research Council and the five volume report prepared as a result of it. While sections of this report dealt specifically with problems of animal productivity, aquatic food resources and research, one study team specifically zeroed in on the topic of information systems and it is in relation to their part of the

report that I would like to direct your attention.[2] This report describes far better than I could, within its framework, the interrelationships which various types of information systems and data bases have within a given subject area. The study team highlights extremely well the interactions and impact which information from a vast array of systems dealing with environmental, toxic substances, and remote sensing research, to mention only a few, can have in terms of planning and management decisions. Ongoing research information in many areas clearly plays a key part in such an approach as that proposed by the study, and today's modern computer technology has provided the means by which to bring much of the needed information together in a readily accessible mode, so that not only can large masses of information be gathered together but the accessibility and retrievability of that information is considerably extended compared to twenty or even five years ago.

What must not be overlooked, however, in spite of all the modern electronic and computer wizardry of today, is the importance of good, well indexed input which must go into such information systems if the output is to be of real value and use. Scientifically trained indexers are essential if we are to go beyond full textual retrieval in order to preserve concepts which might otherwise be lost. This is not to suggest that with further research in indexing techniques, linguistics, lexicography, etc., improved methods will not be developed for processing information into systems much more expeditiously and probably more accurately. To the contrary, I believe we will develop many improvements within the next few years.

Today's problem, however, is a more immediate one. That is locating data bases which may contain information which the user needs about research in progress. Although there are now many directories of data bases currently available for searching, many of these do not give sufficient details on the nature of the data base to allow the user to determine whether or not such a data base will provide information useful to him. With this need in mind the Smithsonian Scientific Information Exchange (SSIE), in cooperation with UNESCO, undertook the compilation of a worldwide inventory of research in progress information systems designed to identify such data bases and define the scope and availability of their information.[3] The compilation is only a preliminary one, and it is expected to be followed up and expanded with greater coverage in the coming years. There are approximately sixty-four data bases in the inventory which have information on agricultural sciences. Obviously if a query were made to all the organizations listed, many would respond by saying they did not have information specifically related to animal health and disease, and in point of fact, when I wrote to many of the organizations listed about the symposium I received such a response. There were a number, however, who said their system contained such information, but in a volume which would not justify their participation in a symposium geared to such a specific subject. Had a more extensive definition been used, however, I believe many of the systems queried would have indicated their holdings were much greater than they originally noted. It is my hope that the individuals planning the preparation of the directory of data base systems in animal health and disease as a part of the symposium program will broaden, and perhaps better define the area of interest which the topic covers. It is

quite possible that the symposium itself and its proceedings will help in this process.

Many of the systems containing information on research in progress, particularly where they are engaged in specialized areas of research, produce directories identifying program or project level research as a product of the data base itself. A quick review of such directories is often quite useful. As an example, on a regional level and not described by a speaker from that organization at the symposium is the data base of the European Communities permanent inventory of agricultural research. The inventory, known as AGREP, was last published in 1977[4] and is currently being updated if my information is correct. This system, which contains information on some 12,000 projects including research on fish and fisheries, has not yet reached full coverage in the veterinary field but is expected to do so in the future and one would be well advised to become familiar with it.

I could cite many directories of research which have been prepared by various ongoing research information centers but will only mention four here as examples of different approaches taken to make such information available in published form. One of these, from Tunisia, deals specifically with agriculture and associated sciences.[5] The others cover much broader areas of science. One of them, prepared by the Consiglio Nazionale della Ricerche (CNR) in Italy, contains descriptive summaries of research in the individual research laboratories performing CNR supported research, in addition to containing information on the research institution and staff. Many directories, as in the case of those from Mexico, Portugal, and Tunisia, will list only titles of the research projects. These and many other publications originating from such centers are described in the inventory referred to earlier.[6] In time, as national systems become more fully developed and achieve greater computerization, I believe they may all try to collect and store abstract information on individual projects as opposed to many which at present collect only titles and other administrative information. Cost of collecting and indexing is always a factor, but as the value of such information becomes better recognized within governments and other organizations which support such systems, we shall see them develop to their full potential for avoiding unwarranted duplication, cross-fertilization of ideas from different disciplines, and better overall research and development planning and management.

A matter of some concern to all of us who prepare or use directories of ongoing research has been the delay between the time of collection of the information and its subsequent publication. I believe we will see this long time delay significantly decreased as the information becomes computerized and the publication process is expedited through the use of computerized files. In all likelihood, as more and more systems become fully computerized, we will see greater national and international online access and networking and more rapid publication and/or delivery of information in hard copy for those not yet so fortunate as to have entered into the world of electronic transfer.

A number of key points emerged from the papers presented in this section and from the discussions which followed.

- Information on research in progress in animal health and disease can be found in a number of national and international data bases, only a few of which are described in detail. Inventories, such as that carried out by UNESCO and SSIE and the one to be prepared as described later in the symposium, can be very helpful in identifying such systems.

  Defining animal health and disease can be important in determining what information, if any, can be obtained from any given data base. The present symposium has been helpful in defining this area of research.

- There is a need for continued development of national data base systems as well as regional and international ones. Such systems might be either centralized or decentralized at the national level and deal with either generalized research or only specific subject areas.

  It is clear that there are no national boundaries where information on science and technology is concerned.

- There is a need for general agreement on which data elements might best be used for exchange purposes but systems should be flexible enough to accommodate the addition of new data elements for national or organizational use only as well as for exchange. A general agreement on indexing terminology or vocabulary, while desirable, may become less critical in the future as full text searching and synonym lists are invoked in indexing and retrieval. General agreement on basic terminology is already reasonably well accepted, all of which is not to imply that further discussion on indexing and classification should not continue at national and international levels.

- A major factor in any system which is to be of maximum value is the quality of the data entered into it and a clear perception of what information is to be retrievable from it. Whatever information enters the system and whatever indexing is applied to it should be of the highest quality possible.

- Retrieval of information from a system should be made as easy as possible for those who use such systems. If use is to be direct (e.g. online), instructions should be simplified as much as possible. Use of trained intermediaries should be helpful in querying a system in the event that professional scientists and engineers elect not to query a system themselves. Published directories of information in general or of specialized subject areas are desirable for use by those to whom online service is not available.

- Electronics and computer wizardry have given us the ability to collect, store, and disseminate large amounts of information but it is still man who must play the major role in its utilization. Better

identification of sources and good input and retrieval techniques will provide the user with information of maximum value, a goal which all of us are seeking.

David F. Hersey,
Chairperson

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THE ROLE WHICH THE CARIS SYSTEM COULD PLAY IN PROVIDING INFORMATION ON CURRENT AGRICULTURAL RESEARCH IN RELATION TO ANIMAL HEALTH AND DISEASE

J. P. Arnould*

Research in relation to animal health and disease is both important and complex. Its importance derives from the rapidly increasing demand for animal products throughout the world and from the frequent scarcity and shortage of animal proteins in several areas of developing countries. Its complexity is due to the fact that this field of research is not only wide in itself, but also overlaps with many other fields of science and technology.

Nevertheless, such research, which is essential if the requirements of each of us are to be met, and which is carried out through an intricate network of fields of research, would be largely unprofitable and valueless if reliable information were not provided on what is being done, where and by whom.

This is the reason why the setting up of data banks is indispensable to those responsible for animal production, as well as to all those interested in the various aspects of animal health and disease.

Could CARIS (Current Agricultural Research Information System) be helpful in this connection? The purpose of this paper is to give a brief description of this new source of information, which is the first attempt on a worldwide basis to make as complete an inventory as possible of the agricultural research effort in developing countries. The CARIS system is ready to work and its role depends on its further utilization, either in its present form or in a modified version.

OBJECTIVES

The CARIS system is an international cooperative information network through which developing countries can collect, organize, and disseminate basic data on their current research—institutions, workers, programs, and projects—in the fields of agriculture, animal production, forestry,

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inland fisheries, and food.

Such an exchange of information aims at improving communication among institutions and scientists, and assisting in the evaluation of the adequacy of existing research efforts, as well as in the identification of major gaps and weaknesses, as an aid to decision-making at both national and international levels.

BACKGROUND

The project was defined in 1965 and was presented for the first time at the 1968 Abidjan Conference on Agricultural Research Priorities for the Economic Development of Africa.

The need for a research information system covering the developing countries, with appropriate links to similar systems in developed countries, was recognized by the Agricultural Development Conference at Bellagio in 1970, where a revised form of the CARIS project was discussed.

FAO then submitted a more specific proposal to the Consultative Group on International Agricultural Research (CGIAR), for consideration by the Technical Advisory Committee (TAC), which recommended that the Group support a pilot project to examine the input data required, the methodology proposed for its collection, and the user demand for the information. The Consultative Group endorsed the need for a project along the lines proposed for CARIS, but also considered that a pilot project was essential to test its feasibility.

FIRST ATTEMPT: THE CARIS PILOT PROJECT

The pilot project supported by several members of CGIAR was initiated in March 1972 and completed in the beginning of 1974 by the publication of directories and an evaluation carried out by the International Development Research Centre.

Fourteen West African countries linked in the West African Rice Development Association (WARDA) were covered by this pilot project. This large geographical area covers a wide range of conditions, with some 250 research institutions of various sizes and types, working in two languages (English and French).

The pilot project collected information on 237 institutions and 1,555 research projects, published in two directories (one in English, one in French).[1] It provided a sufficient diversity of input data, and of data collecting and processing problems, to serve as a valid sample on which to test the methodology and evaluate results in terms of users' requirements,

as well as to shape the global CARIS project.

CURRENT SITUATION: THE GLOBAL CARIS PROJECT

After the results of the pilot project had been evaluated, support was sought for expansion of the project to its global scale, i.e. *covering all research done in or on behalf of developing countries.*

A proposal was made to the Technical Advisory Committee of the CGIAR in July 1974. The objective was to collect, process, and disseminate information on research institutions, workers, programs, and projects, not only in the form of updated directories and indexes at appropriate intervals, but also by establishing a "Question and Answer Service" and a "Service for Selective Dissemination of Information," which would provide topical information on request or for subscribers, including full project descriptions and bibliography on these projects from a computer memory data bank. These services were intended to be provided in liaison with similar research information systems in developed countries as well as with AGRIS for bibliographical information on research results.

The CGIAR endorsed the project, indicating however that, for a starting phase, the project should be limited to the information concerning research institutions, workers, and main lines of research work (programs).

First Phase: Collecting the Data

In July 1975 the Director-General of FAO sent a circular letter to all governments of developing countries that are members of FAO and, for information, to all other FAO member countries, as well as to the international research institutes, inviting them to participate in the worldwide project, and requesting governments to set up a CARIS Liaison Office to act as an intermediary between the research institutions and the CARIS Coordinating Centre located at FAO Headquarters in Rome. Questionnaires—separately designed for institutions, workers, and programs—and instructions for their completion were dispatched in the fall of 1975. Consultants' missions were organized in most developing countries to promote the project, assist in gathering the required data, and insure adequate training of the local staff participating in CARIS, as well as to accelerate the returns.

Out of the 103 countries whose assistance has been solicited in the compilation of this inventory, ninety-seven have designated national liaison offices and sixty have returned completed questionnaires. These, together with returns received from eight international institutes, cover a total of 2,077 research institutions, 9,913 research workers, and 3,310 research programs (the latter corresponding to some 20,000 research projects listed).

Second Phase: Processing the Data

The processing methodology developed at the time of the pilot project was further elaborated so as to be fully adapted to the global project, and the classification, indexing, and coding schemes were revised or updated on the basis of the first returns received.

Given the varying quality, state of completeness, and presentation of the returns themselves, as well as the complication of having to work in three languages (English, French and Spanish), considerable editing (proofreading and corrections) was required before recording. Nevertheless, all the returns received by mid-1977 had been processed (coded and indexed), recorded, proofread, and corrected by March 1978 and were by then available for computer processing.

The computer software (programs and testing) was prepared in collaboration with UNESCO, using as a basis the ISIS (Integrated Set of Information Systems) programs developed originally by ILO and already used by a growing number of developing countries for processing their agricultural literature, as well as by several other international organizations. This basic ISIS software was enhanced to permit its use for multiple data files (e.g. institutions, workers, programs, projects) as required for CARIS and similar systems.

Third Phase: Publishing the Data

Computer processing took place in April 1978 to produce magnetic tapes containing the data and the instructions necessary for photocomposition. Test tapes were produced first and checked for validity, and sample runs of photocomposition were made. After a correction cycle where needed, the final tapes were delivered in May to the photocomposition firm, while other parts of the directories (cover, title pages, introduction, etc.) were sent for typesetting. Photocomposed and typeset parts were delivered to the printers in June. The directories, which represent the result of the global CARIS project in its printed form, were issued at the end of September 1978.

THE DIRECTORIES

The CARIS directories have been issued in a set of three volumes (Vol. 1, Institutions; Vol. 2, Workers; Vol. 3, Programmes) for each of the three official languages of FAO (English, French and Spanish). Each volume contains an introduction, instructions for use, and various tables showing the codes used for the indexes, and is divided into two parts, description (part 1) and indexes (part 2).

Complete bibliographic information on the directories is given in Table 1.

TABLE 1. List of CARIS Directories

ENGLISH SET

CARIS (Current Agricultural Research Information System).
Agricultural Research in Developing Countries.

Volume 1. Research Institutions, Rome: FAO, 1978.
ISBN 92-5-100593-1 (633 pp.)

Volume 2. Research Workers. Rome: FAO, 1978.
ISBN 92-5-100593-1 (683 pp.)

Volume 3. Research Programmes. Rome: FAO, 1978.
ISBN 92-5-100593-1 (1,302 pp.)

FRENCH SET

CARIS (Système d'Information sur les Recherches Agronomiques en Cours).
La recherche agronomique dans les pays en developpement.

Volume 1. Institutions de recherche. Rome: FAO, 1978.
ISBN 92-5-200593-5 (633 pp.)

Volume 2. Chercheurs. Rome: FAO, 1978.
ISBN 92-5-200593-5 (687 pp.)

Volume 3. Programmes de recherche. Rome: FAO, 1978.
ISBN 92-5-200593-5 (1,357 pp.)

SPANISH SET

CARIS (Sistema de Información sobre Investigaciones Agronomicas en Curso).
La investigacion agronomica en los paises en desarrollo.

Volumen 1. Instituciones de investigación. Roma: FAO, 1978.
ISBN 92-5-300593-9 635 pp.)

Volumen 2. Investigadores. Roma: FAO, 1978.
ISBN 92-5-300593-9 (686 pp.)

Volumen 3. Programas de investigación. Roma: FAO, 1978.
ISBN 92-5-300593-9 (1,358 pp.)

Volume 1, Research Institutions

Part 1 (trilingual), Description. This descriptive part provides all important data collected through the questionnaires on research institutions, country by country. It also gives an alphabetical list of all institutions covered.

Part 2 (in English, French, or Spanish), Indexes. This part permits access to the data contained in Part 1, specifically through three indexes

(one by objects, subdivided by fields of science; the second by fields of science, subdivided as needed by objects or activities; the third, by climates). An alphabetical listing of all classification terms used gives in turn access to the above mentioned indexes.

An example of linkage between the description and the indexes is given in Figure 1.

Volume 2, Research Workers

Part 1 (trilingual), Description. This descriptive part provides, in alphabetical order of research workers' names, the data collected through the questionnaires on research workers. It also gives a list of institutions in alphabetical order of the codes for easy reference.

Part 2 (in English, French, or Spanish), Indexes. This part permits access to the data contained in Part 1, specifically through two indexes (one by objects, subdivided by fields of science; the second by fields of science, subdivided as needed by objects or activities). An alphabetical listing of all classification terms used gives in turn access to the indexes.

An example of linkage between the description and the indexes is given in Figure 2.

Volume 3, Research Programmes

Part 1 (trilingual), Description. This descriptive part provides, country by country, and within each country, institution by institution, the data collected through the questionnaires on research programs, i.e. the program title (in three languages)—and when provided in the returns, a short description—followed by the titles (in English, French, or Spanish) of the research projects included in each program.

Part 2 (in English, French, or Spanish), Indexes. This part permits access to the program data contained in Part 1, specifically through two indexes (one by objects, subdivided by activities; the second by activities, subdivided by objects). An alphabetical listing of all classification terms used gives in turn access to the indexes.

An example of linkage between the description and the indexes is given in Figure 3.

THE DATA BASE AND OTHER SERVICES

The most important part of the data collected has been *recorded in computer memory* and is therefore available for reproduction on magnetic tape, and

FIGURE 1. Example of Linkage between Description and Indexes in the CARIS System (Research Institutions)

Research institutions

DESCRIPTION

ZZ.130. - INTERNATIONAL LABORATORY FOR RESEARCH ON ANIMAL DISEASES (ILRAD)

P.O. Box 30709
Nairobi, Kenya
Tel:592219, 592244, 592246
Cable: ILRAD NAIROBI

Long: E.036.45 - Lat: S.01.20 - Alt: 1 544 m

Climate: 1770

Supervisory body: Board of Trustees of ILRAD

Staff: 45 scientists + 75 technicians

Languages: Official: EN

Experimental fields: Range land 65 ha - Other 14 ha

Specialized equipment: Elmiscope 102 and Autoscan Electron - Spectophotometer PMQ3 - Immuno Electrophoresis LKB 2117-401 - Preparative Ultracentrifuge L5-65 - Liquid Chromatograph 1220 - Liquid Scintillation Spectrophotometer 330 - Trypanosome cultures

Training facilities: Post-Doctoral (160 weeks)

Background: For several years, scientists, administrators and public officials considered the possibility of establishing an advanced centre for research on animal diseases located in an area where the target diseases were endemic. Several study groups comprised of animal disease scientists and representatives of donor agencies concurred in the need for such an effort initially on trypanosomiasis and theileriosis (East Coast Fever). As a result, in 1973 the Consultative Group on International Agricultural Research concluded a Memorandum of Agreement with the Government of Kenya establishing ILRAD in Nairobi, Kenya

General fields of activity: Immunological procedures for the prevention of trypanosomiasis and East Coast Fever in cattle.

Financial support: $ 4 963 000

INDEX

INDEX BY FIELDS OF SCIENCES AND TECHNIQUES

Animal protection against trypanosomiasis and vectors (B3440)
NG 621.

C3810 ANIMAL PARASITOLOGY
Bovines (A4110)
BR.591e

C3811 VIROLOGY (ANIMALS)
Creation and use of resistant species or varieties (B3147)
TR.100.

C3812 BACTERIOLOGY (ANIMALS)
Bovines (A4110)
VE.213.

C3814 PROTOZOOLOGY (ANIMALS)
Animal protection against trypanosomiasis and vectors (B3440)
ZZ.130.
Animal protection against other protozoan diseases and vectors (B3450)
ZZ.130.

C3820 ANIMAL METABOLIC DISEASES

C3821 ANIMAL NUTRITION DISEASES
Bovines (A4110)
PG.171.

C3830 ANIMAL IMMUNOLOGY
Vaccines (A5742)
EG.140. IR.170.
Sera (A5743)
EG.140. IR.170.
Animal protection against trypanosomiasis and vectors (B3440)
ZZ.130.
Animal protection against other protozoan diseases and vectors (B3450)
ZZ.130.

C3860 VETERINARY MEDICINE

C3861 EPIDEMIOLOGY - PROPHYLAXY
Vaccines (A5742)
KR.212.

C3862 ANIMAL PHARMACOLOGY
Poultry and Birds (A4300)
PH.123m

FIGURE 2. Example of Linkage between Description and Indexes in the CARIS System (Research Workers)

Research workers

PERSONAL DATA

HUH Jong Soo - (1928.03.05) - KR
(1) KO — (2) KO — (3) KO — (4) National Fisheries University of Busan Marine Biology 1952 — (5) KR.240. — (6) Senior Fisheries Scientist of Deep-sea Fisheries Resources Section — (7) 16.2 ka Namhangdong. Youngdogu. 606. Busan. Korea — (8) Study on the distribution of zoo plankton near East sea in Summer

HUHN Sebastião
(5) BR.132. — (7) Caixa Postal 48. Travessa Dr. Eneas Pinheiro - Bairro do Marco. 66000. Belém. Brazil

HUIVSMAN
(7) Apdo. 5969. Lima. Perú — (8) Potato Breeding.

HUIZINGA Berend - (1940.07.20) - NL
(1) NL EN. FR — (2) NL EN — (3) NL FR. EN — (4) Agricultural University. Wageningen. The Netherlands. Land Bouwkundig Ingenieur (M.Sc. Agric. Sciences) - 1968 — (5) NG.400. — (6) Lecturer/Research Fellow Grade I — (7) P.O. Box 1044 Samaru. Zaria. Nigeria — (8) Agric. Extension. Rural Institutions. Rural Sociology.

HULMAN Beedeeanan - (1945.03.07) - MU
(1) EN. FR. HI — (2) EN. FR. HI — (3) EN. FR. HI — (4) B.Sc (Agr) Allahabad University. India. 1972. — (5) MU.100. — (6) Scientific Officer (Animal Husbandry). — (7) Curepipe. Mauritius — (8) Tropical Animal Production - Sugar Cane and its by Products.

HUMPHREY John David - (1946.04.27) - AU
(1) EN — (2) EN — (3) EN — (4) B.VSc. (Melbourne 1969) - M.Sc. James Cook Univ. Townsville. Q'ld. 1974 — (5) PG.001. — (6) Veterinary Pathologist — (7) P.O. Box 6372. BOX 6372. BOROKO. (Veterinary Laboratory. Kila Kila PG. 180. — (8) Diagnostic and systemic pathology - Bovine Genital Pathology - Pathology of parasitic diseases (poultry)

HUQ Mainul - (1952.11.30) - BD
(1) BE. EN — (2) BE. EN — (3) BE. EN — (4) B.Sc. 1971 - M.Sc. 1973 — (5) BD.005. — (6) Assistant Scientific Officer (Tea Research) — (7) Srimongal. Sylhet. Bangladesh — (8) Agricultural Science - Plant Pathology

HUQ Md. Abdul - (1943.07.14) - BD
(1) BE. EN — (2) BE. EN — (3) BE. EN — (4) B.Sc. (1965) - M.Sc. (1967) - M.Sc. (1970) — (5) BD.600. — (6) Lecturer. — (7) Bangladesh — (8) Animal Breeding and Animal Science.

HUQ Md. Saidul - (1943.10.31) - BD
(1) BE. EN. UR — (2) BE. UR. EN — (3) AR. BE. EN — (4) B.Sc. Soil Science. Dacca University 1966. - Higher training in Agriculture Economics from Faculty of Agriculture & Food Technology. Osijek. Zagreb University. Yugoslabia. 1976 — (5) BD.001. — (6) Scientific Officer. Research Work in Agriculture. — (7) A.C. BARI. Tajgaon. Bangladesh — (8) Soil Science - Research work in Agriculture and fertilizers

INDEXES

INDEX BY OBJECTS

A4110 BOVINES

Permanent intensive grazing (C3434)
Paladines. O.L.

Nematology (plants) (C3714)
Owen. I.L.

Animal pathology and veterinary sciences (C3800)
Calderon Monterrosa. J.E.
Humphrey. J.D.
Ribeiro. L.A.O.

A4300 POULTRY AND BIRDS

Animal parasitology (C3810)
Humphrey. J.D.
Manuel. M.F.

Virology (animals) (C3811)
Bahk. K.S.

INDEX BY FIELDS OF SCIENCES AND TECHNIQUES

C3800 ANIMAL PATHOLOGY AND VETERINARY SCIENCES

Noxious arachnida (Ticks, ...) (A1572)
Ross. J.P.

Ruminants (A4100)
Briouga. I.
Falvey. J.L.
Sedrati. A.
Thanvalappitak. E.
Torres. C.A. A.T.
Zambrano Mendoza. J.

Bovines (A4110)
Calderon Monterrosa. J.E.
Humphrey. J.D.
Ribeiro. L.A.O.

C3810 ANIMAL PARASITOLOGY

Buffaloes (A4122)
Tongson. M.S.

Sheep (A4140)
Owen. I.L.

Swines (A4220)
Manuel. M.F.

Poultry and Birds (A4300)
Humphrey. J.D.
Manuel. M.F.

FIGURE 3. Example of Linkage between Description and Indexes in the CARIS System (Research Programmes)

Research programmes

DESCRIPTION

INTERNATIONAL LABORATORY FOR RESEARCH ON ANIMAL DISEASES (ILRAD) (ZZ.130.)

ZZ.130.AA.
- **Immunological Procedures for the Control of Trypanosomiasis**
- *Procédures immunologiques de lutte contre la trypanosomiase*
- **Procedimientos inmunológicos para el control de la tripanosomiasis**

Projects - Operations - Proyectos

- Define the Pathogenesis of experimental and Spontaneous Trypanosomiasis in cattle (ZZ.130.0001.)
- The epidemiology of spontaneous trypanosomiasis in cattle with emphasis on reinfection and persistence of the organism. (ZZ.130.0002.)
- The role and Mechanism of Immunosuppression in Trypanosomiasis in cattle. (ZZ.130.0003.)
- The Pathogenesis of the anaemia in bovine trypanosomiasis. (ZZ.130.0004.)
- The in vitro propagation of trypanosomes in cell free Culture and in bovine and tsetse cell cultures. (ZZ.130.0005.)
- Trypanosome antigens in vitro and in vivo with emphasis on those responsible for protection and therole of antigenic modulation in the disease and factors that determine its occurrence. (ZZ.130.0006.)
- Investigate the occurrence and protective role of the humoral and cellular immune responses in infected cattle. (ZZ.130.0007.)
- Develop effective immunization procedures for trypanosomiasis (ZZ.130.0008.)

INDEXES

INDEX BY OBJECTS

A4110 BOVINES

Study of immunity and of pest and disease resistance (B3110)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

Animal protection against trypanosomiasis and vectors (B3440)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

Cell cultures (B8241)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

Animal immunology (B8630)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

Epidemiology - prophylaxy (animals) (B8661)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

INDEX BY ACTIVITIES

B3110 STUDY OF IMMUNITY AND OF PEST AND DISEASE RESISTANCE

Bovines (A4110)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

B3440 ANIMAL PROTECTION AGAINST TRYPANOSOMIASIS AND VECTORS

Bovines (A4110)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

B8241 CELL CULTURES

Bovines (A4110)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

B8630 ANIMAL IMMUNOLOGY

Bovines (A4110)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

B8661 EPIDEMIOLOGY - PROPHYLAXY (ANIMALS)

Bovines (A4110)
Immunological Procedures for the Control of Trypanosomiasis ZZ.130.AA

for machine retrieval in answer to specific questions. Also in computer storage are various "authority files," such as the classification tables and codes used for indexing, in three languages (English, French, Spanish).

The *software* used during the project has been documented and is available for future decentralized CARIS operations (see next section), as well as to any country which might require it with a view to developing an information system similar to CARIS.

On the basis of the experience gained during the processing of the data, the two main *classification tables* (Table A, objects, and Table B, activities) have been revised so as to permit as complete indexing as possible with the minimum of keywords.

Similarly the *questionnaires* used for the inventory have been partly redesigned on the basis of processing experience, particularly as regards the "tag" structure for computer use. The questionnaires are available in French. English and Spanish versions will be made available on request.

EXPECTED DEVELOPMENT OF CARIS OPERATIONS

After completion of the present stage, the CARIS program will be carried out in a decentralized manner, in which

- o national and/or regional CARIS centers will assume the responsibility for data collection, processing, and publishing, as well as for services to users;

- o the CARIS Coordinating Centre at FAO Headquarters will be responsible for the promotion of, and methodological assistance to, the national/regional centers, as well as for the development and maintenance of a common methodology, and of a global data base (on tape) resulting from the contributions of the participating centers.

Several countries have already indicated their willingness and capability to take over the responsibility for CARIS operations in their territory, or indicated their desire to acquire the ISIS/CARIS software and/or to receive assistance for the setting up of local CARIS systems.

Two national CARIS systems are already operational:

Brazil: Within the framework of UNDP/FAO Project BRA/72/020 (National System for Agricultural Documentation and Information), the data collected for the CARIS worldwide project were published in 1977 in two volumes, in Portuguese. They have been updated and augmented in 1978 and a new edition is being processed. Information is held in the computer, from which SDI (Selective Dissemination of Information)

services are provided. (For further information see "A Computerized Information System on Current Agricultural Research Projects in Brazil," by J. Robredo, P. F. Curvo Filho, D. F. Sullivan and Y.S. Chastinet, in this volume.)

Tunisia: Within the framework of UNDP/FAO Project TUN/75/003 (Centre National de Documentation Agricole), the data collected for the CARIS worldwide project were published in December 1976 in one volume, in French (*La Recherche en Cours: Agriculture et Sciences Associées/ Programmes, Chercheurs, Institutions* (Tunis, CNDA)). The data have been updated and completed in 1978 and a new edition is being processed.

Three regions (or groups of countries) have demonstrated active interest in setting up regional cooperative CARIS networks:

Latin America: All Latin American countries participate already very actively in AGRIS (Agricultural Information Service) and at the same time in AGRINTER (the Latin American equivalent to AGRIS) through the Interamerican Institute for Agricultural Sciences (IICA), San José, Costa Rica. The existence of this information network offers promising perspectives for assuming responsibilities for CARIS operations.

Southeast Asia: Similarly, the member countries of SEARCA (Southeast Asian Regional Centre for Graduate Study and Research in Agriculture) are very active participants in AGRIS, through their regional network, AIBA (Agricultural Information Bank for Asia). This organization could act as a CARIS regional center.

Arab countries: Several Arab countries have shown interest in cooperating to set up a regional CARIS network for the Arabic speaking countries, and the AOAD (Arab Organization for Agricultural Development) has indicated its willingness to contribute to such a project.

Two methodologies will be offered to countries or regions interest in acting as national/regional CARIS centers:

The methodology used for the worldwide project—covering detailed information on institutions, workers, and programs/projects—including questionnaires, instructions, classification tables (augmented), and computer software.

A simpler methodology, currently being tested at FAO, essentially describing, in a single record, research projects (including name(s) of research worker(s), institution/address, title of project in local language and in English, start/end dates, duration, research program, and indexing codes).

The simpler methodology corresponds closely to that adopted by the European Communities for the AGREP (Agricultural Research Projects) information system, and is analogous to that used by AGRIS to describe documents, through decentralized input from more than one hundred participating

centers.

It is felt that such a dual approach will permit more countries to participate sooner in a decentralized CARIS system. Those with well-developed documentation infrastructures may prefer immediately to adopt the more complete system, from which they could also derive simpler data. Other countries will initially more readily adopt the simpler methodology (which does, however, collect meaningful data), and they can progressively shift to the more complete data system as their capacities increase.

The shift from the centralized to the decentralized method of operation for the CARIS program can only be gradually implemented, as countries or groups of countries indicate interest and willingness to participate. However, subject to agreement with the interested institutions and availability of resources, a start can be made in the near future with the regional groups already mentioned.

REFERENCES

1. CARIS, *Directory of Agricultural Research Institutions and Projects in West Africa* (Rome: FAO) (MI/E2792/F12.73/1/1200).

   CARIS, *Repertoire des institutions et projets de recherche agronomiques en Afrique de l'Ouest* (Rome: FAO) (MI/E2792/F12.73/1/1250)

SSIE: A VERSATILE INFORMATION SYSTEM ON RESEARCH IN PROGRESS

William T. Carlson*

The Smithsonian Science Information Exchange (SSIE) has, since its beginning in 1949, become renowned both nationally and internationally through the services it has provided to the scientific, educational, and administrative communities. These services center around a basic document known as a Notice of Research Project, or NRP. The NRP is composed of the following data elements: the supporting agency; project title; principal investigator and co-investigators; identification number(s) (an SSIE number, a supporting organization number, and/or a performing organization number); beginning and ending dates for the project, and the fiscal year to which the report pertains; funding data (when provided to SSIE); and a project summary of 200 to 250 words. (See Figure 1.)

The versatility of the SSIE system is centered in *three separate, yet integrated areas:* (1) subject data; (2) administrative data; and (3) the various ways these data may be selected and packaged according to the needs of the user.

SUBJECT DATA

The versatility of the subject data is, in turn, based on several factors.

Subject Analysts

First, all subject analysts have professional training, usually at the master's or doctorate level, and usually with some research experience. This provides them with both the knowledge of their subject disciplines and an empathy for the information needs of the administrators and scientists in these same fields. It is their responsibility to recognize the interactions and interdisciplinary aspects of the projects. This responsibility is met by (a) thoughtful design of the subject indexes, (b) careful indexing to the subject areas each may be responsible for, and

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*William T. Carlson is Chief, Agricultural Sciences Branch, Smithsonian Science Information Exchange, Washington, D.C. The views expressed in this paper are those of the author and do not necessarily reflect the views of the Exchange.

FIGURE 1. Notice of Research Project

SMITHSONIAN SCIENCE INFORMATION EXCHANGE

Room 300 • 1730 M Street, N.W. • Washington, D.C. • 20036
Telephone (202) 381-4211 • Telex 89495

SSIE NUMBER

1CA-22524-2

NOTICE OF RESEARCH PROJECT

SUPPORTING ORGANIZATION:

U.S. Dept. of Health Education & Welfare
Public Health Service; National Inst. of Health
National Cancer Inst.
9000 Rockville Pike; Bethesda, Maryland 20014

SUPPORTING ORGANIZATION NUMBER(S):

R01 CA 22524-02

PROJECT TITLE:

METABOLISM AND TOXICITY OF PYRROLIZIDINE ALKALOIDS

INVESTIGATOR(S):

PROF DR BUHLER
PR CHEEKE
C MIRANDA
RL REED
HS RAMSDELL

DEPARTMENT/SPECIALTY:

AGRICULTURAL CHEM

PERFORMING ORGANIZATION:

OREGON STATE HIGHER EDUC. SYS.
SCHOOL OF AGRICULTURE
126 AGRICULTURE HALL
CORVALLIS, OREGON 97331

PERIOD FOR THIS NRP:

7/77 to 6/79
FY78 Record

PROJECT SUMMARY:

This study is aimed at establishing whether there is a public health hazard resulting from consumption of meat and dairy products derived from livestock feeding on tansy ragwort (Seneco jacobea), a widely dispersed plant containing the hepatotoxic pyrrolizidine alkaloids. The toxicity of milk and tissue from cows and goats will be initially determined in feeding studies with rats. We will also study the absorption, excretion, distribution and metabolism of seneciphylline and jacobine, the two principal pyrrolizidine alkaloids from tansy ragwort, in two species of laboratory animals, the rat (susceptible) and the guinea pig (resistant), and in two species of lactating farm animals, the cow (susceptible) and the goat (resistant). Particular emphasis will be placed on isolating and characterizing reactive metabolites of the pyrrolizidine alkaloids, establishing whether covalent binding of such metabolites to tissue constituents occurs, and in establishing the mechanism(s) for toxicity of the alkaloids to mammals.

ADDENDA:
1. Funding details from source: FY78 $ 59,736

INVESTIGATORS (CONT)

RE GOEGER
RA SWICK

then (c) additional routing of the project to other branches where further indexing for associated subject disciplines is encountered. For example, in the area of animal health there is a great overlap of responsibilities between the "Agricultural and Applied Biological Sciences Branch," the "Basic Biology Branch," and the "Medical Sciences Branch."

Design of Indexes

The second factor contributing to the versatility of the SSIE system resides within the careful design of the subject indexes. In SSIE jargon, a "subject index" represents a concise topic which may be subdivided in outline fashion up to five hierarchical levels. Each index consists of a numeric code, the caption for each code, and a unique term used by the analyst when indexing. The latter is a simplified term, easily recognized by the analyst and associated and remembered for use in context with the index, whereas a long, numeric code is not so easily remembered. This unique term, when used, is converted by the computer into a numeric code equivalent and stored. The numeric code may vary in length, dependent upon the number of hierarchical levels; however, the digit length of each level is fixed upon a 4 - 2 - 3 - 2 - 3 digit sequence.

Each index may be based upon either a concept, keywords, or upon some combination of these two. Appropriate indexing usually involves the use of all three types of indexes.

An example of a conceptual index is shown in a page from our Animal Husbandry Index (Figure 2). In this index, the first series of numeric codes (0210) identifies the index itself. The index hierarchy follows, which in this example is only comprised of either one or two additional levels. The caption "Beef Husbandry" (10) is a two digit code and is also a "higher level." This is followed by the caption "Breeding, Beef" (10-100) and is referred to as a "lower level." The analyst uses the term "N-BEEF-BREED" when he indexes; however, the complete code, 0210-10-100, is used to retrieve the same concept from the computer.

An example of keyword indexes is the Mammals Index (Figure 3). The scientific nomenclature of the various organisms is used whenever possible to avoid the confusion encountered with common names. Exceptions to this rule in this example are terms such as ruminants, livestock, deer, and miniature swine.

There are two indexes representing a combination of concepts and keywords which aptly apply to the retrieval of animal health data. These are the Pesticide Index and the Vertebrate Pathology and Disease Index. The Pesticide Index (Figure 4) has been in operation for fifteen years. In this index the second level designates the target use of the pesticide. On the page shown, the code "10" stands for insecticides. The third level (a three digit code) is used to provide information relating to the chemical structure and composition of the compound. At this level, each digit of this three digit code has a specific meaning. For instance, "131" used anywhere within the entire pesticide index with any second

FIGURE 2. Example of Subject Index

0210 Animal Husbandry INDEXING PRINT 09/20/78

			0
10		Beef Husbandry	
10	100	Breeding, Beef	N-BEEF-BREED
10	600	Management, Beef	N-BEEF-MAN
10	995	Beef Husbandry -other	N-BEEF-O
15		Pathology -cattle	N-CATTLE-PATH
20		Dairy Husbandry	
20	100	Breeding, Dairy	N-DAIRY-BREED
20	600	Management, Dairy	N-DAIRY-MAN
20	995	Dairy Husbandry -other	N-DAIRY-O
27		Farm Animals -other Oxen,Water Buffalo,Elephant,Reindeer Llama,Etc.	N-FARM-ANIM-O
30		Fur-bearing Animals	
30	100	Breeding, Fur Animals	N-FUR-BREED
30	600	Management, Fur Animals	N-FUR-MAN
30	710	Pathology, Fur Animals	N-FUR-PATH
30	995	Fur Husbandry -other	N-FUR-O
40		Horses	
40	100	Breeding, Horse	N-HORSE-BREED
40	600	Management, Horse	N-HORSE-MAN
40	710	Pathology, Horses	N-HORSE-PATH
40	995	Horse Husbandry -other	N-HORSE-O
50		Laboratory Animals	
50	100	Breeding, Lab Animals	N-LAB-A-BREED
50	600	Management, Lab Animal	N-LAB-A-MAN
50	710	Pathology, Lab Animals	N-LAB-A-PATH

FIGURE 3. Example of a Partial Subject Index

0758 Mammals		INDEXING PRINT 12/13/78
75	Artiodactyla	
75 050	Antilocapridae	O-ANTILOCAPRID
75 100	Bovidae	
75 100 11	Bos (Dairy Cattle)	O-DAIRY
	Holstein, Jersey, Guernsey, Ayrshire	
75 100 12	Bos (Dual-purpose Cattle)	O-DUAL-BOS
	Milking Shorthorn, Brown Swiss	
75 100 13	Bos (Beef Cattle)	O-BEEF
	Angus, Hereford, Shorthorn, Brangus	
75 100 14	Bos -other	O-BOS-O
75 100 15	Bos -nonspecific	O-BOS-NS
75 100 16	Bos indicus	O-ZEBU
75 100 17	Exotic Beef Cattle	O-EXOTIC-BEEF
75 100 20	Capra	O-CAPRA
75 100 60	Ovis	O-OVIS
75 100 95	Bovidae -other	O-BOVID-O
75 110	Livestock -nonspecific	O-LIVESTOCK-NS
75 120	Ruminants -nonspecific	O-RUMINANT
75 200	Cervidae	
75 200 05	Alces	O-ALCES
75 200 10	Cervus	O-CERVUS
75 200 15	Deer -nonspecific	O-DEER
75 200 20	Odocoileus	O-ODOCOILEUS
75 200 25	Rangifer	O-RANGIFER
75 200 95	Cervidae -other	O-CERVID-O
75 700	Suidae	
75 700 71	Sus (Domestic Pig)	O-SWINE
75 700 72	Sus (Miniature Swine)	O-MIN-SWINE

FIGURE 4. Sample Page of Pesticide Index

0744 Pesticides		INDEXING PRINT 09/20/78
10 129 01	Dupont 1642	N-PEST-DUPONT-1642
10 129 02	Thiofanox	N-PEST-THIOFANOX
10 139	Aliphatic Phosphorothioate Cpd	
10 139 01	Malathion	N-PEST-MALATHION
10 139 02	Mocap	N-PEST-MOCAP
10 139 03	Monitor	N-PEST-MONITOR
10 139 04	TD 8550	N-PEST-TD-8550
10 139 05	Counter	N-PEST-COUNTER
10 139 06	Aspon	N-PEST-ASPON
10 141	Aliphatic Organophosphorous Chlorinated Cpds.	
10 141 01	Trichlorfon	N-PEST-TRICHLORFON
10 141 02	DDVP	N-PEST-DDVP
10 142	Aliphatic Organophosphorous Halogenated Cpds. (Other Than Cl)	
10 142 01	DFP	N-PEST-DFP
10 143	Aliphatic Organophosphorous Mixed Halogenated Cpds.	
10 143 01	Naled	N-PEST-NALED
10 148	Aliphatic Organophosphorous	
10 148 01	Orthene	N-PEST-ORTHENE
10 149	Aliphatic Organophosphorous Cpds. (Non-phosphorothioates)	
10 149 01	Tetraethyl Pyrophosphate	N-PEST-TEPP
10 149 02	Bidrin	N-PEST-BIDRIN
10 149 04	Malaoxon	N-PEST-MALAOXON
10 149 05	C 2307	N-PEST-C-2307
10 159	Aliphatic Organophosphorous Cpds. Ns	

level (designating target uses such as insecticides, nematicides, fungicides, herbicides, etc.) would have the following meaning: The first digit, "1," indicates a compound with an aliphatic structure; the "3," when used as the second digit, indicates an organophosphorous compound with a double bond sulfur; the third digit, "1," indicates that at least one chlorine is found in the compound. Malathion is, therefore, the first pesticide encountered at SSIE (code "01" at the "lowest level") meeting the description of an aliphatic organophosphorous (with a double bond sulfur) chlorinated insecticide (0744-10-131-01).

This illustration is used to demonstrate how effectively intelligence can be superimposed into the numeric coding of an index. Once the code has been assigned, it is not necessary that the analyst know the use of a pesticide or have any knowledge essential upon retrieval other than to recognize the proper codes to use; furthermore, neither is it necessary to use multiple terms or codes for retrieval of such data.

The Vertebrate Pathology and Disease Index will be described later.

Special Reference Lists

Supportive reference or thesauri lists, especially prepared as SSIE indexing and retrieval tools-of-the-trade, represent a third factor contributing to the versatility of the SSIE system. An example from the Plant Reference List (Figure 5) illustrates how references can be made, using either the scientific name, common name, or the inverted form of the common name to identify the proper place a plant is to be indexed, or from where it is to be retrieved. Regardless of which of these terms may be encountered, there is just one place for indexing and retrieval. Similar reference thesauri have been prepared for vertebrates, invertebrates, pesticides, plant diseases; one is now being contemplated for animal diseases.

Types of Indexing

A fourth factor contributing toward versatility is related to SSIE's two-step method of indexing. A series of approximately twenty carefully controlled vocabulary modules has been prepared and stored within the computer to provide the first subject indexing for a project. A selection of the most appropriate of the controlled vocabulary modules is made for broad subject disciplines, such as Animal Sciences. Upon the initial indexing of a project, it is assigned to one of these subject disciplines for the purpose of computer indexing. The computer compares the terminology of the Title and the Project Summary with the terminology of the selected modules. The corresponding indexing is applied by the computer to the project.

Therefore, through the judicious assignment of terms to one or more of these modules, it is possible for the computer to differentiate, on a problematic basis, whether the context of a word such as "corn" is

FIGURE 5. Plant Reference List

REFERRAL LISTING

REFERRAL CAPTION		UNIQUE LAST TERM	XR	SUBJECT CODE
CORCHORUS OLITORIUS		O-CORCHORUS	04	0284-20-244-20
CORDAITALES		O-CORDAITALES	00	0283-38-300-40
CORDGRASS, SMOOTH		O-SPARTINA	03	0285-20-050-60
CORDIA SPP.		O-CORDIA	40	0284-02-030-15
CORDYLINE TERMINALIS		O-CORDYLINE	02	0285-29-200
COREOPSIS		O-COMPOS-O	MO	0284-03-065-95
CORIANDER		N-CON- (ETC)	03	0245-30- ETC
CORIANDER		O-UMBELLIF-O	51	0284-21-252-95
CORIANDRUM SPP.		O-UMBELLIF-O	50	0284-21-252-95
CORIARIACEAE		O-CORIARIAC	00	0284-03-068
CORIOSPERMUM SPP.		O-CHENOPODIAC-O	20	0284-03-056-95
CORK ELM	S	O-ULMUS-O	21	0284-21-251-8Z
CORK OAK		O-QUERCUS-O	69	0284-06-100-4Z
CORKBARK FIR		O-A-LASIOCARPA	05	0283-38-300-
CORN (FIELD)		N-CER- (ETC)	03	0205-05- ETC
CORN (POP)		N-CER- (ETC)	03	0205-05- ETC
CORN CHAMOMILE		O-COMPOS-O	55	0284-03-065-95
CORN COCKLE	S	O-AGROSTEMMA	03	0284-03-049-05
CORN POPPY		O-PAPAVER	07	0284-16-188-60
CORN ROSE	S	O-AGROSTEMMA	03	0284-03-049-05
CORN SPURRY		O-DROSERAC	21	0284-04-088
CORN-MARIGOLD		O-CHRYSANTHEMUM	07	0284-03-065-25
CORN, (INDIAN)		N-ORN-MON- (ETC)	03	0245-50-210ETC
CORN, DENT		O-Z-MAYS	05	0285-20-120-8A
CORN, FIELD		O-Z-MAYS	07	0285-20-120-8A
CORN, FLINT		O-CORN-O	01	0285-20-120-8X
CORN, GUINEA	S	O-PENNISETUM	15	0285-20-100-60
CORN, INDIAN		O-CORN-O	03	0285-20-120-8X
CORN, POD		O-CORN-O	05	0285-20-120-8X
CORN, POP		O-POP-CORN	01	0285-20-120-8B
CORN, SWEET		N-VEG-AERIAL- (ETC)	13	0245-70-100ETC
CORN, SWEET		O-SWEET-CORN	01	0285-20-120-8C
CORNACEAE		O-CORNAC-O	00	0284-03-069-95
CORNECEAE		O-CORNAC-O	00	0284-03-069-95
CORNEL		O-CORNUS	01	0284-03-069-20
CORNEL, DWARF		O-CORNUS	15	0284-03-069-20
CORNEL, DWARF		O-CORNAC-O	27	0284-03-069-95
CORNEL, SMALL ROUGHLEAF		O-CORNAC-O	21	0284-03-069-95
CORNELIAN CHERRY		O-CORNUS	11	0284-03-069-20
CORNFLOWER		O-CENTAUREA	09	0284-03-065-22
CORNSALAD, BEAKED		O-VALERIANAC	31	0284-22-255
CORNUS ALTERNIFOLIA		O-CORNUS	10	0284-03-069-20
CORNUS CANADENSIS		O-CORNUS	14	0284-03-069-20
CORNUS DRUMMONDI		O-CORNUS	16	0284-03-069-20
CORNUS FLORIDA		O-CORNUS	02	0284-03-069-20
CORNUS MAS		O-CORNUS	10	0284-03-069-20
CORNUS NUTTALLII		O-CORNUS	06	0284-03-069-20
CORNUS OBLIQUA		O-CORNUS	12	0284-03-069-20
CORNUS PAUCINERVIS		O-CORNUS	18	0284-03-069-20
CORNUS SPP.		O-CORNUS	00	0284-03-069-20
CORONILLA		O-CORONILLA	00	0284-12-188-29
CORONOPUS SPP.		O-CRUCIF-O	50	0284-03-074-95
CORTADERIA		O-FESTUCEAE-O	02	0285-20-060-95
CORYANTHE YOHIMBE		O-RUBIAC-O	E0	0284-18-213-95

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intended as an animal ration component, a food for human consumption, a growing plant, an adjective such as in "corn borer," or a prefix as in "cornflower."

The second indexing step is made by the subject analyst. At this stage, the computer indexing is reviewed to insure that the indexing was in proper context, and further indexing is added as needed. Appropriate modifications to the vocabulary modules are continually being made to improve the initial indexing. In this manner, the time required for the adequate indexing of a project has been greatly reduced for each of the various agricultural subject disciplines. This method of computer indexing has proven to be especially applicable to coordinating synonyms, common names, or scientific names, or the indexing of keywords in general. There are, of course, limitations. For example, the computer can recognize the term "calcium" but not its symbol, "Ca"; however, the reverse is true when the symbol "Pb" poses no problem of recognition, but the word "lead" cannot be distinguished as between the element and the verb. It is for such reasons that the subject analyst is considered a necessary component of the indexing process.

Retrieval Skills

A fifth factor of versatility pertains to the interaction of the SSIE subject analyst and his ability to organize the numerical codes selectively for retrieval of the appropriate projects. This skill, based upon its day-to-day development through the combined tasks of indexing and of retrieving data, is not available to the user of the SSIE data files from an online vendor.

Returning to the theme of this conference, retrieval of information relating to animal health, you have seen how the concepts such as cattle pathology are collected in a single code, as are specific diseases, causal organisms, toxins, or other keyword specifics. Speaking as an agronomist, I admit to a special type of difficulty when asked to retrieve information on broad topics such as "reproductive disorders of livestock," "respiratory diseases of poultry," or "congenital diseases of the horse." The Vertebrate Pathology and Disease Index has been designed to allow one to retrieve all appropriate studies without being a veterinarian, in the same manner as the pesticide index can be used by a non-chemist or one not active in pest control. Its primary divisions, coded into the first digit of the two digit "second level" code, are as follows:

0 - General
1 - Cardio-vascular Systems
2 - Digestive Systems
3 - Endocrine & Metabolic Systems
4 - Blood, Lymph & Reticular Endothelial Systems
5 - Muscle, Skeletal, Connective Tissue & Skin Systems
6 - Nervous Systems
7 - Respiratory Systems
8 - Sensory Systems
9 - Reproductive Systems

The next two digits (the second digit of the "second level" and the first digit of the "third level") are used to provide for one or two sub-levels under each of the above systems.

The following two digits (digits two and three of the "third level") comprise a sub-category which is descriptive of the pathological condition. The first of these is as follows:

0 - General
1 - Infections
2 - Congenital
3 - Heritable
4 - Non-infective
5 - Nutritional
6 - Tumors
7 - Inflammation
8 - Degenerative
9 - Multiple Causes

The second code, in turn, modifies the preceding digit, identifying specific conditions applicable to this particular sub-category. For example, the digits following the "1" of "Infections" have been assigned as follows:

10 - General Cause
11 - Bacterial, Spirochete, or Actinomycete Cause
12 - Fungal Cause
13 - Protozoal Cause
14 - Physical or Environmental Cause
15 - Viral or Rickettsial Cause
16 - Non-disease Cause
17 - Multiple Causes
18 - unassigned
19 - unassigned

The next two digits (the fourth level code) are assigned in sequence to each disease or disorder meeting the preceding sets of conditions. In this particular index, there are seven hierarchical levels built into the space normally allocated for just four levels. While it is impractical to present the entire index, the following example given for appendicitis illustrates how the hierarchies of numerical codes and their corresponding meanings are used.

0296-	VERTEBRATE PATHOLOGY & DISEASE INDEX
0296-2	Digestive System
0296-25	Gastro-Intestinal Pathology
0296-25-5	Appendix
0296-25-57	Inflamation
0296-25-570	Inflammation - general
0296-25-570-01	<u>APPENDICITIS</u>

ADMINISTRATIVE DATA

Returning to the second area of versatility, there are several elements of administrative data given in the NRP which are indexed and retrievable, such as the supporting organization, and mailable address; the performing organization, and mailable address; specific investigators; and fiscal years. (See Figure 1.) These elements may be retrieved individually or in combination with each other, or in combination with any selection of subject topics.

USER SERVICES

The third area of versatility illustrates some of the major ways that the SSIE data have been selected and packaged for users. The initial product was the "Custom Search," a personalized service in which those NRP's are selected which are judged most closely relevant to the requester's inquiry. Through the years other services have been added: periodic monthly or quarterly updating of subject requests; computer generated special reports available in a variety of formats; catalog or directory production; linotron tapes; microfiche; special thesauri; investigator name searches; interchange tapes; online availability; marketing of specially prepared subject packages; and other services as the situation warrants.

CONCLUSION

It is important to recognize that while SSIE has grown through the years in scope and services, the concept of personalized service continues to exist. It is with this concept that SSIE will continue to expand its services whenever possible to meet the expanding needs of the scientific and research management communities.

USDA/CRIS AS A SOURCE OF PROJECT INFORMATION ON ANIMAL HEALTH AND DISEASE RESEARCH

Philip L. Dopkowski*

Over 25,000 active and recently completed projects on agricultural and forestry research are documented in the Current Research Information System (CRIS). Of these, approximately 2,000 are animal health and disease related, including some 700 projects recently acquired from twenty-two accredited U.S. schools and colleges of veterinary medicine. As part of the CRIS master file, the latter are available for technical retrieval and are being updated with financial and staff support information for inclusion in CRIS-based management inventories and reports.

BACKGROUND

Increasing pressure from government, industry, and the scientific community for better and more complete agricultural research information led USDA to establish a task force in July 1964 to investigate the feasibility of developing an automated system for the storage and retrieval of project information on agricultural and forestry research in the United States. As a direct result of task force recommendations, CRIS was established in April 1966, and became operational as an inhouse service on July 1, 1969. Online capability was introduced in June 1976, with public access made available commercially in February 1977. With creation in 1978 of the USDA Science and Education Administration (SEA), CRIS was transferred to Technical Information Systems, a SEA unit which also encompasses the National Agricultural Library and a number of computer-based management and bibliographic retrieval systems.

OBJECTIVES

CRIS was designed with two basic purposes in mind: first, to improve communication among agricultural and forestry research scientists; and

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secondly, to provide research managers with up-to-date and coordinated information on total research programs at the state, regional, and national levels. Specifically, CRIS provides access to both project abstract and management information on current research conducted by the group of institutions collectively referred to as the USDA-State Agricultural Experiment Station complex. These institutions include the four USDA research agencies (Agricultural Research, Cooperative Research, Economics, Statistics, and Cooperatives Service, and Forest Service), the fifty-six State Agricultural Experiment Stations, nineteen State Forestry Schools, sixteen Land-Grant Colleges of 1890, and the Tuskegee Institute. It is estimated that these institutions conduct about ninety-five percent of the publicly supported agricultural and forestry research in the United States. Information from additional sources is currently being input to CRIS. This includes research projects from twenty-two U.S. accredited schools and colleges of veterinary medicine and those from a growing number of participants in the new USDA Competitive Grant Program.

SOURCE DOCUMENTS

The source of project documentation in CRIS is the Research Work Unit, which is a set of four documents consisting of a Research Resume, Classification Report, Report of Funds and Staff Support, and Progress and Publications Report. These documents originate at the research location. The Research Resume and Classification Report are submitted to CRIS at the time a research project is initiated, while the remaining two are submitted annually for each year the project is active. The principal investigator or the administrative unit most closely identified with the research has responsibility for submitting source documents to CRIS. Instructions for completing and routing the reports are contained in a manual provided each of the responsible administrative units.

Research Resume

This is a one-page document which provides the title of the project, a statement of the objectives of the research, and an indication of the investigator's approach. Included are the name of the performing department, institution name and location, names of principal and co-investigators, start and termination dates, and agency or department identification numbers and codes. Investigators also suggest keywords that highlight the objectives or plan of work.

Classification Report

This is also a one-page document which broadly describes the research according to a series of classifications contained in the CRIS *Manual of Classification of Agricultural and Forestry Research.*[1] The manual serves as the authority for classifying all projects in CRIS and is furnished to

all institutions preparing CRIS inputs.

All projects are coded to four sets of primary classifications and, in certain cases, to specific subcommodities and special interest categories. Primary classifications are Activity, General Commodity, Field of Science, and Research Problem Area. Broad areas in the Activity group include, for example, resource conservation, production efficiency, quality improvement, and protection of crops and animals from disease, loss or damage. The latter includes a separate Activity for the protection against diseases, parasites and nematodes, and all projects dealing with diseases in livestock would be classified to this Activity. General Commodity refers to specific crops, animals or their products, or human organizational and institutional resources that are the focus of the research. Poultry, swine, dairy, beef cattle, and wildlife are separately classified by Commodity. Field of Science covers seventy-eight disciplines in the biological, physical, social, and behavioral sciences and includes, for example, animal pathology, animal physiology, parasitology, immunology, and animal virology. The Research Problem Areas correspond to the Department's long range goals for agricultural research and consist of ninety-eight topics, including animal diseases, internal parasites, and external parasites affecting livestock, poultry, and other animals. The classification manual also includes a series of classifications for subcommodity and special categories such as pollution, pesticides, and energy. Subcommodities include, for example, cheese, meat, and milk under the primary Commodity, dairy cattle.

In addition to the classification, percentage of effort in each category applicable to the research is also reported. This gives CRIS the capability of producing a wide array of management reports that are used by research managers for research planning and coordination.

Funds and Staff Support

This report provides the substantive data for most of the management reports generated by CRIS. For funding information, annual expenditures or appropriations are reported by source and categorized as USDA, other federal, or non-federal support. Staff support, also reported on an annual basis, is given in years or portions of years of effort contributed by scientists, professionals, and technical and support personnel assigned to a project. The Report of Funds and Staff Support is submitted to CRIS annually after the close of each fiscal year. Previous years' reports are transferred to separate financial files that are individually searchable.

Progress and Publications Report

This is the final set of the four documents comprising the Research Work Unit. It is submitted annually and covers research findings for the previous calendar year. The report also allows the investigator to list significant or important publications that came out of the research during the progress report period. Citations to journal articles may be listed

as well as theses, dissertations, USDA and State Agricultural Experiment Station publications, books, and conference papers. Some of these may be classed as fugitive literature not always included in cataloging and indexing and abstracting services or bibliographic data bases. While the active CRIS file contains only the most current Progress and Publications Reports, previous years' reports are kept in a history file which may be separately searched.

FILE SIZE

Currently, over 25,000 active research projects are documented in CRIS. Approximately 2,000 cover animal health and disease research and they include over 700 projects from schools and colleges of veterinary medicine. In terms of file activity, approximately 2,000 new projects are input to the system each year. A new project is entered at the time it is initiated and remains in the active file for two years beyond its termination date. After this period, the project is removed from the system. Each year, approximately 2,000 projects are retired, so that file size remains somewhat constant on a yearly basis. Approximately 2,000 revisions to active projects are entered in CRIS annually. These are handled as changes to existing projects.

SYSTEMS PRODUCTS

While the extent of CRIS services is varied, depending on the client and the information needed, all outputs are the result of searches of the computer master file, the progress and publications history file, or previous years' financial files. Most searches are on-demand and are in response to written or telephoned requests.

Project Abstract

This form of output is normally provided in response to technical subject matter requests, and for each retrieved project lists the title, investigator's name, research location, objectives, approach, latest progress, and citations to the most recent publications resulting from the research. Figure 1 is an example of the project abstract, commonly called the Standard Technical Printout.

Funding and Staff Support Summary

This describes a category of outputs that are based on CRIS management data. The format in Figure 2 illustrates the capability of the system to aggregate funding and staff support data by research classification and to

FIGURE 1. Standard Technical Printout

AD-357 (2/78) U.S. DEPARTMENT OF AGRICULTURE SCIENCE AND EDUCATION ADMINISTRATION RESEARCH WORK UNIT/PROJECT ABSTRACT CURRENT RESEARCH INFORMATION SYSTEM				CRIS ID NO. IH331A; DATE 28 NOV 1978
ANIMAL-HEALTH & DISEASE RESEARCH/STAND TECH PRINT			START DATE 06 AUG 1969	TERMINATION DATE 13 DEC 1979
ACCESSION NO. 0020692	WORK UNIT/PROJECT NO. 1502-20460-005	REGIONAL PROJECT NO.	CONTRACT/GRANT/AGREEMENT NO.	AGENCY IDENT. ARS 1502
LOCATION PO BOX 848 GREENPORT LI NEW YORK 11944			PERFORMING ORGANIZATION PLUM ISLAND ANIMAL DIS CENTER	
INVESTIGATORS CAMPBELL C H	SWANEY L M		RICHMOND J Y	
TITLE VARIATION AND SELECTION OF AVIRULENT FOOT-AND-MOUTH DISEASE VIRUS				

OBJECTIVES:
Produce new strains of virulent and avirulent foot-and-mouth disease virus under natural and artificial conditions to learn how strains arise in the field and how the genetics of the virus may be manipulated to obtain viruses with certain desired characteristics.
APPROACH:
Two procedures will be used to produce new strains of virus: pressures applied directly to the virus such as physical and chemical treatments and pressures applied by the host cell system. Using virulent and avirulent parent viruses, the roles of selection, mutation, recombination, exposure to adverse environments, and growth in cells of varying susceptibility will be assessed in relation to origin of new strains. Genetic characteristics of the viruses will be studied to determine how the emergence of new field strains may be predicted and how viruses with certain desired characteristics may be obtained.
PROGRESS REPORT: 77/01 77/12
Unlike other subtypes of the 7 antigenic types of FMDV tested, O(1) Brugge was relatively nonpathogenic for 28-day-old mice. Mice became inapparently infected, however, and virus titers in such mice were as high as those in mice that died following inoculation of pathogenic virus. The inapparent infection reduced the clinical effects of virulent strains of all of the 7 antigenic types of FMDV including type O. Three FMDV temperature-sensitive (ts) mutants showing different degrees of attenuation for infant mice retained their genetic markers during serial tissue culture passage. Recovery of mouse-virulent ts virus after passages of the mutants in mice suggested that these were not covariant expressions of the same locus, but were under the control of different genes. Study of reversion of a ts mutant of FMDV passaged in several types of cell cultures revealed that the type of host cell influences the selection of revertants. In addition, guanidine-resistant mutants of this ts mutant were readily obtained by alternate passage of the virus in medium with and without guanidine HCl. In a study of defective-interfering particles, bovine kidney cells grew back after infection with FMDV and were found after 37 passages to be highly susceptible to FMDV. The cells apparently were no longer infected with FMDV and are now being investigated for use in the growth and assay of this virus.
PUBLICATIONS: 00 ADDITIONAL PUBLICATIONS
RICHMOND, J.Y. 1977. Evidence for a mouse pathogenicity locus in certain temperature-sensitive mutants of foot-and-mouth disease virus. Infect. and Immunity 16:827-831.
ADNERSEN, A.A. 1977. Differences of growth and virulence of large and small plaque SAT 1(5) foot-and-mouth disease viruses. Conf. Res. Workers in Anim. Dis., 58th Annual Meeting (Abstract #111).

FIGURE 2. Funding and Staff Support Summary by Agency, Research Problem Area, Commodity and State

CURRENT RESEARCH INFORMATION SYSTEM 05 OCT 1978 CRIS ID 825610
ANIMAL HEALTH AND DISEASE RESEARCH
FY 1977 RELATED FUNDS AND SYS

AGENCY	RPA	COMM	STATE	CSRS/USDA	OTH-FED	NON-FED	TOTAL	SYS
ARS	211	3000	ALA	$64381	$0	$0	$64381	.6
ARS	211	3000	CAL	$43409	$0	$0	$43409	.0
ARS	211	3000	COL	$270639	$0	$0	$270639	1.6
ARS	211	3000	IOW	$2174995	$18347	$0	$2193343	16.6
ARS	211	3000	KE	$99391	$0	$0	$99391	.7
ARS	211	3000	MD	$34202	$0	$0	$34202	.5
ARS	211	3000	MIN	$11275	$0	$0	$11275	.0
ARS	211	3000	MO	$70239	$0	$0	$70239	.6
ARS	211	3000	NY	$4140097	$77999	$0	$4218096	15.1
ARS	211	3000	OKL	$97694	$0	$0	$97694	.7
ARS	211	3000	ORE	$46826	$0	$0	$46826	.4
ARS	211	3000	PA	$42810	$0	$0	$42810	.2
ARS	211	3000	TEX	$116782	$0	$0	$116782	.8
ARS	211	3000	TZ	$0	$102835	$0	$102835	1.7
ARS	211	3000	WN	$7989	$0	$0	$7989	.1
TOTAL **				$7220729	$199181	$0	$7419910	39.5

summarize it by organizational level. This type of output is most often used at task force or committee level for program reviews and developing research priorities. Other forms of output that combine both textual information and management data, including all assigned classifications and their percentages, are also produced. An example of this is the Modified Technical Printout shown in Figure 3.

Recurring Publications

CRIS prepares two series of publications based on CRIS data that are periodically produced in bound form. The *Inventory of Agricultural Research* provides annual financial and staff support data aggregated by agency, state and region, and two primary CRIS classifications—Research Problem Area and Commodity. The *Cycle for Projecting and Analyzing Research Program Adjustments* spans a five-year projections period and is produced biannually. Both publications serve research administrators and managers as research review and planning documents.

PROCESSING

All input data are stored on magnetic tape. Master file updates and maintenance and retrieval programs are run on an IBM 370/168 computer, and disc storage accommodates some eighteen separate tables, a file of classification codes, and a keyword file of 18,000 terms with approximately one half million postings. Peripheral equipment includes a Datapoint 6600 System which is used primarily for formatted data entry and housekeeping functions. Processing is by batch mode except for a number of maintenance and retrieval functions run on the Datapoint. Programs are written in ANSI/COBOL.

All projects in CRIS are indexed for computer retrieval. Keywords are derived from concepts appearing in project descriptions and from terms suggested by project investigators. The CRIS *Keyword Bank*,[2] a list of over 16,000 subject terms, serves as the semi-controlled authority for indexing. CRIS uses a coordinate indexing approach and searching is based on concept coordination and Boolean logic. Both keywords and classification codes may be used in conjunction with each other for search purposes and may be combined using the logical connectors, AND, OR, and AND NOT.

The CRIS staff numbers fourteen, and includes four technical information specialists, four programmer-analysts, and three data input clerks. Both indexing and searching are performed by technical information specialists who have master's and bachelor's degrees in biology and the life sciences.

FIGURE 3. Modified Technical Printout

AD-357 (2/78)

U.S. DEPARTMENT OF AGRICULTURE
SCIENCE AND EDUCATION ADMINISTRATION

RESEARCH WORK UNIT/PROJECT ABSTRACT
CURRENT RESEARCH INFORMATION SYSTEM

CRIS ID NO. IH331A				
DATE 28 NOV 1978				
ANIMAL-HEALTH & DISEASE RESEARCH/MS TECH PRINT		START DATE 06 AUG 1969	TERMINATION DATE 13 DEC 1979	
ACCESSION NO. 0020692	WORK UNIT/PROJECT NO. 1502-20460-005	REGIONAL PROJECT NO.	CONTRACT/GRANT/AGREEMENT NO.	AGENCY IDENT. ARS 1502
LOCATION PO BOX 848 GREENPORT LI NEW YORK 11944			PERFORMING ORGANIZATION PLUM ISLAND ANIMAL DIS CENTER	
INVESTIGATORS CAMPBELL C H	SWANEY L M		RICHMOND J Y	
TITLE VARIATION AND SELECTION OF AVIRULENT FOOT-AND-MOUTH DISEASE VIRUS				

FISCAL YEAR	CSRS ADM/ USDA APPN	OTHER FEDERAL	NON FEDERAL	TOTAL	SYS
1977	$1136386	$0	$0	$1136386	4.3

ACTIVITY		COMMODITY		SCIENCE		RPA	PRODUCT
4600	100%	3000	50%	0513	50%	211	25%
4600	100%	3000	50%	1410	50%	211	25%
4600	100%	3100	30%	0513	50%	211	15%
4600	100%	3100	30%	1410	50%	211	15%
4600	100%	3200	20%	0513	50%	211	10%
4600	100%	3200	20%	1410	50%	211	10%

SPECIAL COMMODITY	
3199	30%

OBJECTIVES:
Produce new strains of virulent and avirulent foot-and-mouth disease virus under natural and artificial conditions to learn how strains arise in the field and how the genetics of the virus may be manipulated to obtain viruses with certain desired characteristics.

APPROACH:
Two procedures will be used to produce new strains of virus: pressures applied directly to the virus such as physical and chemical treatments and pressures applied by the host cell system. Using virulent and avirulent parent viruses, the roles of selection, mutation, recombination, exposure to adverse environments, and growth in cells of varying susceptibility will be assessed in relation to origin of new strains. Genetic characteristics of the viruses will be studied to determine how the emergence of new field strains may be predicted and how viruses with certain desired characteristics may be obtained.

USDA/CRIS ONLINE

To make CRIS more readily available to USDA and state researchers, CRIS contracted for online service in 1976 with Lockheed DIALOG Information Retrieval Service. Through this service, CRIS technical data may be accessed by remote terminal from virtually any location in the United States. Direct access is also possible from many locations in Canada, Mexico, Western Europe, South America, Australia, and the Philippines. The online system is interactive and permits both free-text searching of the title, objectives, approach, keyword, progress, and publications blocks, and code searching of all primary and subcommodity classifications for all projects in the file. Nine formats and a series of sort options are available. Because of its proprietary nature, funding information is not available online.

CRIS SERVICES

CRIS inhouse services are available primarily to individuals in CRIS participating institutions, but requests for technical information from other federal agencies, state and private colleges and universities, state and local governments, and some foreign governments are also honored. However, outputs consisting of financial data, particularly on a project by project basis, are limited to select client groups, principally USDA research administrators and managers.

All searches processed inhouse are provided without charge to authorized users. Individuals in the private sector are referred to the Smithsonian Science Information Exchange, which adds new and revised CRIS projects to its files on a quarterly basis, or to the Lockheed online service. In both cases costs are borne by the user.

For users in CRIS participating institutions, use of Form AD-427, Request for Information Retrieval, is encouraged for requesting inhouse searches. The critical element of a request is a narrative description of the subject of interest, and terms from the *Keyword Bank* and codes from the *Manual of Classification* may be added for further definition. Format and print fields may also be specified and the purpose of the request may be indicated. Requests should be sent to

Technical Information Systems
Current Research Information System
USDA/SEA
National Agricultural Library Building
Beltsville, Maryland 20705

REFERENCES

1. U.S. Department of Agriculture, Current Research Information System, *Manual of Classification of Agricultural and Forestry Research*, rev. III (Washington, D.C.: U.S. Department of Agriculture, 1978).

2. U.S. Department of Agriculture, Current Research Information System, *Keyword Bank in CRIS* (Washington, D.C.: U.S. Department of Agriculture, 1976).

A COMPUTERIZED INFORMATION SYSTEM ON CURRENT AGRICULTURAL RESEARCH PROJECTS IN BRAZIL

Jaime Robredo,
Plácido F. Curvo Filho,
Daniel F. Sullivan,
Yone S. Chastinet*

In 1975, through the Brazilian National System for Agricultural Information and Documentation (Sistema Nacional de Informaçao e Documentaçao Agricola, SNIDA) of the Ministry of Agriculture, Brazil formally incorporated itself into the international Current Agricultural Research Information System (CARIS) which is coordinated by the Food and Agriculture Organization of the United Nations (FAO). SNIDA is operated by the National Agricultural Library of Brazil (Biblioteca Nacional de Agricultura, BINAGRI) and is a modern large-scale documentary and research information system in the field of agriculture.**

In 1976/77 the first practically exhaustive survey of current agricultural research in the country was carried out, and the data sent to the CARIS Project Coordinating Centre, FAO, in Rome, at the beginning of 1977, to be included in the outputs planned for the CARIS System (magnetic tapes and printed directories).

At the same time, adequate mechanisms were developed for the most rapid dissemination possible of the collected data relative to research institutions, research workers, current agricultural research programs and projects.[1] During the second half of 1977 a directory was published with the available data,[2] and at the beginning of 1978 a computerized subject index (KWIC type) was published which allowed access to program and project titles. Updating of the initial data was quickly done during the first half of 1978. New printouts of the updated data were to be published before the end of 1978.

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**The United Nations Development Program (UNDP) and the Food and Agriculture Organization of the United Nations (FAO) are collaborating, through the Project UNDP/FAO/BRA/72/020, in the implementation of the Sistema Nacional de Informaçao e Documentaçao Agricola.

This concluded the first phase in the implementation of the Brazilian Current Agricultural Research Information System (BRACARIS).

The overall design of the BRACARIS system provides for (a) constant updating of data; (b) yearly publication of directories and indexes of each updating; (c) generation of magnetic files and the creation and maintenance of a constantly updated data base to permit dissemination and retrieval of stored information.

The BRACARIS system embraces all aspects of current agricultural research in Brazil, including data on agricultural economics and production, animal diseases, and other aspects of interest to the agricultural sector (forestry, food technology, fisheries, etc.). Included in this paper are figures and examples of printouts which illustrate the general system design and the present state of its implication.

DESIGN OF THE BRACARIS SYSTEM

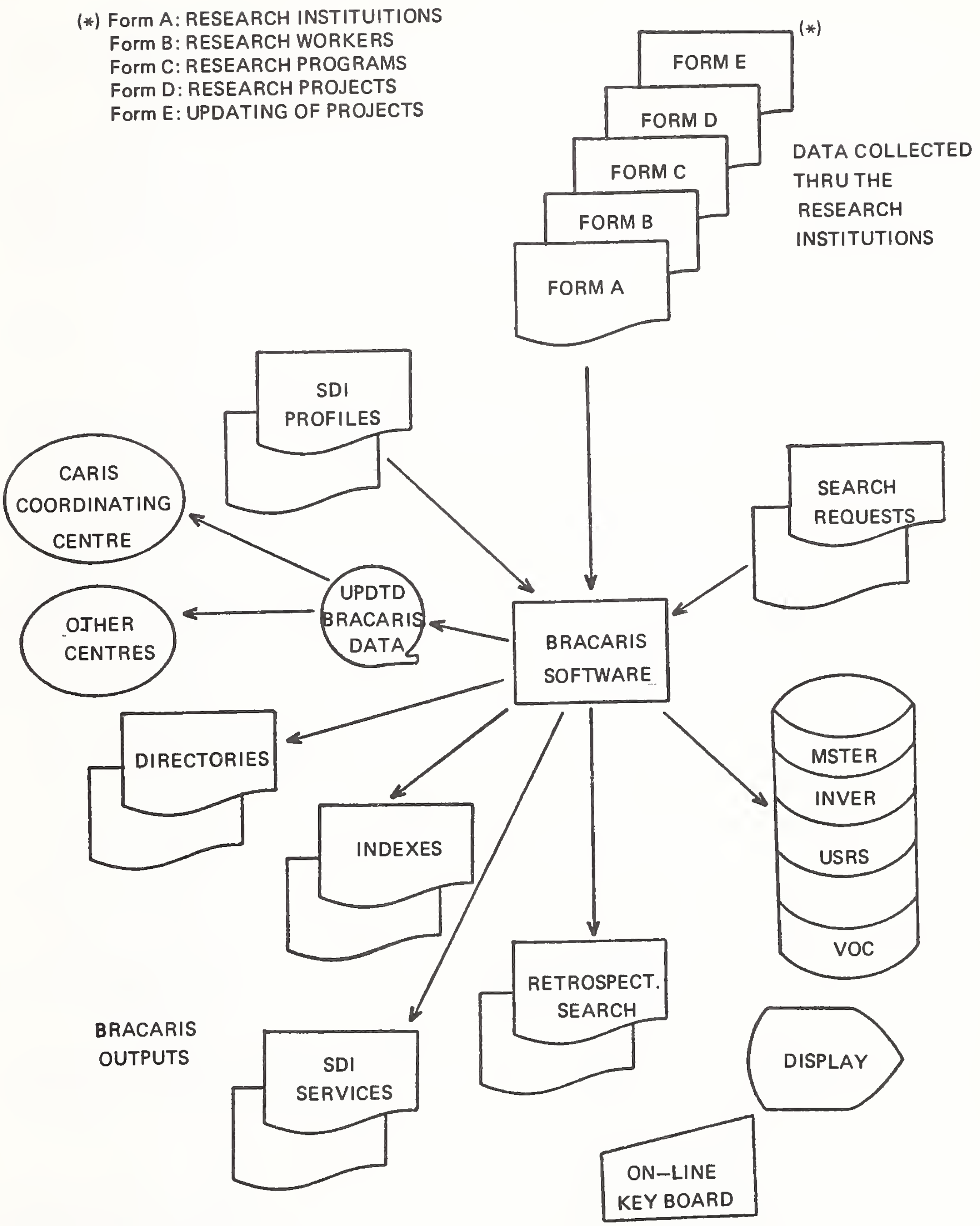
The general BRACARIS system design shown in Figure 1 does not include interaction with the CARIS Coordinating Centre, nor acquisition of current agricultural research data from other countries in the CARIS system (currently seventy countries) which would enrich and expand considerably the possibilities for selective dissemination of information (SDI) services and information retrieval.

The BRACARIS software, which is simply an extension of the field of application of the software developed by SNIDA, allows for

- input cycle;
- formatting of files for processing;
- automatic indexing of records by key words or expressions in research program or project titles;
- file updating and maintenance:
    - addition of new records,
    - modification or replacing of existing records,
    - deletion of records;
- data processing for generating directories and indexes:
    - index of institutions,
    - index of research workers,
    - index of research programs,
    - index of research projects;
- production of current reference printouts selected in accordance with user profiles (SDI);
- retrospective search, at user's request.

The expanded utilization of the data base for information retrieval by means of an interactive system is in an advanced stage of study.

FIGURE 1. General Design of the BRACARIS System



BRACARIS SYSTEM OUTPUTS

The different types of outputs generated by the system are illustrated here as follows:

Figures 2 to 4 represent, respectively, a page from the directory of institutions (including a list of programs/projects developed by each institution), a page from the list of research workers (including biographical data), and a page from the alphabetical list of institutions.[4] Figure 5 shows a page from the alphabetical index of programs and projects.[5]

The updated outputs to be generated by the system this year will differ somewhat from the first outputs indicated above.

- o The list of institutions remains unchanged, except that program and project data will now appear in the general index (see below).

- o The list of research workers remains the same, except for an increase in numbers due to the fact that in the initial survey only research workers responsible for the project were included, and now the names of collaborators will be included when available.

- o The completely computerized general index will bear marked differences from the prior edition:

  - o the KWIC type index has been replaced by a KWOC type index (Figure 6);

  - o the alphabetical index of research workers and research institutions will be part of the general index (Figures 7 to 9);

  - o a list of projects terminated during the updating stage as well as a list of new projects (or projects identified for the first time) are included (Figure 9);

  - o each ongoing, new or terminated project has its own code for access to more complete data (program, institution responsible, research workers, etc.) (Figure 10).

The general panorama of information on current agricultural research in Brazil, resulting from the initial survey, has been changed only moderately by the new data. Approximately sixty new research institutions were identified and contacted, and consequently the total number of research projects increased somewhat. The number of research workers increased because a large number of research collaborators are now included.

Table 1 illustrates the differences between the data of the first survey of 1976/77 and the update for 1977/78.

FIGURE 2. List of Brazilian Agricultural Research Institutions (including Data on Research Programs/Projects and Research Workers Responsible). The Entries for Institutions Follow a Geographical Arrangement (by Region and State).

Emprego do Cornea Test (Cortes, J. de A.; Nilsson, M.R.; Vasconcellos, S.A.)
- Toxoplasmose em suínos: identificação das áreas endêmicas do Estado de São Paulo, pela prova de hemaglutinação e apreciação das variáveis epidemiológicas de maior implicação na sua ocorrência (Ishizuka, M.M.)
- Toxoplasmose em equinos PSI - Estudo sorológico em soros de equinos PSI suspeitos de toxoplasmose (Brogliato, O.F.; Cunha, R.A.F. da; Ishizuka, M.M.; Miguel, O.)
- Avaliação das condições sanitárias do pescado fresco distribuído na cidade de São Paulo (Baptista, I.; Riccetti, R.V.)
- Ação do NaCl na concentração comumente usada em frigoríficos, na preparação da linguiça de porco sobre a inativação do C. cellulosae (Barbuto, O.J.M.; Moreno, A.G.; Panetta, J.C.; Riccetti, R.V.)
- Estudo sobre Sarcocystis (Ogassawara, S.; Ramirez, J.G.)
- A vacinação anti-aftosa como causa de aborto em fêmeas da espécie bovina (Cortes, J. de A.; Vasconcellos, S.A.)
- Avaliação da prevalência da Toxoplasmose em rebanho bovino (Brogliato, O.F.; Ishizuka, M.M.)
- Incidência de germes dos grupos coliforme e enterococo em leite em pó consumido na cidade de São Paulo (Panetta, J.C.; Ramos, M.)
- Diagnóstico da raiva em cães. Emprego do teste de Córnea (Cortes, J. da A.; Ito, F.H.; Nilsson, M.R.; Rozas, C.E.E.; Vasconcellos, S.A.)
- Estudos sobre a prova cultural de Hotis no diagnóstico da mastite bovina (Cury, R.; Costa, E.O. da)
- Estudos sobre a nova técnica de preparo de vacina contra adenite equina (Costa, E.O. da; Cury, R.)
- Histoplasmose experimental em cães expostos a um reservatório natural do agente (Costa, E.O. da)
- Estudo da mastite micótica (Costa, E.O. da; Cury, R.)
- Ocorrência de toxoplasmose em equinos PSI (Hutyra, V.; Ishizuka, M.M.; Lenci, O.; Macruz, R.)
- Bacteriometria do leite in natura e de alguns lacticínios consumidos na cidade de São Paulo (Panetta, J.C.)
- Microbiologia de iogurtes produzidos na cidade de São Paulo (Barbuto, O.J.M.; Loureiro, M.B.)
- Efeito da aplicação de imunossupressor em cães experimentalmente infectados com Toxoplasma gondii; observação de lesões oculares (Ishizuka, M.M.; Ribeiro Neto, I.)
- A ação virucida de alguns desinfetantes comerciais sobre o vírus tipo "C" Waldmann de febre aftosa (Côrtes, J. de A.; Ito, F.H.; Rozas, C.E.E.; Vasconcellos, S.A.)
- Emprego da glicerina como elemento auxiliar na conservação do vírus da febre aftosa (Côrtes, J. de A.; Ito, F.H.; Rozas, C.E.E.; Vasconcellos, S.A.)
- Salmonelose aviária (Hipólito, O.; Silva, E.N. da; Tsung, M.M.)
- Ação do Phenyl-imidothiazole (PIT) na recuperação de lesões deixadas pelo vírus da febre aftosa (Côrtes, J. de A.; Ito, F.H.; Ramirez, J.G.; Rozas, C.E.E.; Souza, J.V. de; Vasconcellos, S.A.)
- Pesca exploratória na represa de Ponte Nova, Rio Tietê, Estado de São Paulo (Campos, E.C.; Miguel, O.)
- Estudos sobre a coriza infecciosa das galinhas. I. Caracterização morfológica, cultural e sorológica de amostras de H. gallinarum, isoladas no País (Bottino, J.A.; Hipólito, O.; Narita, H.)
- Ação descontaminante do Paratolueno-Cloro-Sulfamida-Sódico em ovos destinados à industrialização (Augusto, A.; Panetta, J.C.; Riccetti, R.V.)
- Comportamento do Paratolueno-Cloro-Sulfamida-Sódico na descontaminação da água de escaldamento de suínos abatidos (Augusto, A.; Panetta, J.C.; Riccetti, R.V.)
- Estudo da incidência e da relação entre acidez e sobrevivência de germes dos grupos coliforme e enterococo em iogurte (Barbuto, O.J.M.; Loureiro, M.B.)
- Efeitos do Phenyl-imidothiazole (PIT) sobre a resposta imunitária de cobaios tratados com vacina anti-aftosa (Côrtes, J. de A.; Ito, F.H.; Ramirez, J.G.; Rozas, C.E.E.; Souza, J.V. de; Vasconcellos, S.A.)

BR 386
DEPARTAMENTO DE PRODUÇÃO ANIMAL DA FACULDADE DE MEDICINA VETERINÁRIA E ZOOTECNIA DA UNIVERSIDADE DE SÃO PAULO

Endereço: Caixa Postal 23 13630 Pirassununga - SP
Telefone: 2766; 2781; 2791; 2792; 2793

Longitude: W 047 59 *Latitude:* S 21 59 *Altitude:* 634m

Órgão supervisor: Faculdade de Medicina Veterinária e Zootecnia

Instituição superior: Universidade de São Paulo

Pessoal: 12 pesquisadores

Campos experimentais: Pastos cultivados: 32 ha; outros: 24 ha

Equipamento especializado: Câmara climática para animais, laboratórios

Publicações: Revista da Faculdade de Medicina Veterinária e Zootecnia

Áreas gerais de atividade: Nutrição animal, alimentação animal, agrostologia, criação animal, melhoramento animal, bioclimatologia zootécnica

Programas/Projetos de Pesquisa:

Alimentação Animal - Gado de Corte
- Blocos melaçados para novilhas Nelore (Velloso, L.)
- Níveis de proteína e energia digestíveis para zebuínos em crescimento e engorda (Velloso, L.)
- Ganho de peso com mestiços Chianina e Zebu (Velloso, L.)
- Cama de galinheiro para bovinos Nelore (Nogueira Filho, J.C.M.)

Alimentação Animal - Gado Leiteiro
- Administração de concentrados para vacas em lactação (Lucci, C. de S.)
- Blocos melaçados para vacas em lactação (Lucci, C. de S.)
- Blocos melaçados para bezerros desmamados (Lucci, C. de S.)
- Produção de leite em pastagens consorciadas (Lucci, C. de S.)
- Desaleitamento precoce de bezerros (Lucci, C. de S.)
- Blocos melaçados para novilhos e novilhas leiteiras (Velloso, L.)
- Aleitamento múltiplo para bezerros (Oliveira Filho, E.B. de)
- Substituição da silagem de milho por cana-de-açúcar para vacas em lactação (Nogueira Filho, J.C.M.)
- Silagem de sorgo, com ou sem lablab, para vacas em lactação (Nogueira Filho, J.C.M.)

Avicultura
- Comportamento de linhagens de poedeiras (Ghion, E.)
- Criação de aves para corte e postura em diferentes lotações (Moretti, A. de S.)

Melhoramento Animal
- Efeitos genéticos quantitativos na fertilidade de bovinos Canchim (Oliveira Filho, E.B. de)
- Parâmetros fenotípicos e mesológicos da produção de leite e gordura da raça Pitangueiras (Lobo, R.B.)
- Estudo genético da eficiência produtiva e reprodutiva em bovinos Pitangueiras (Lobo, R.B.)
- Estudo genético de desempenho produtivo de um rebanho Gir leiteiro (Lobo, R.B.)
- Cariotipagem de reprodutores usados em inseminação artificial (Lobo, R.B.)
- Estudo genético de anormalidade do ouvido em suínos (Masotti, N.)
- Desmama de leitões aos 42 e 56 dias (Masotti, N.)
- Medidas de carcaças de suínos (Masotti, N.)
- Desempenho de suínos durante a fase de terminação (Masotti, N.)
- Desempenho produtivo e reprodutivo de matrizes Duroc (Schlindwein, A.P.)
- Eficácia reprodutiva de dois rebanhos de suínos (Schlindwein, A.P.)

Nutrição Animal
- Ensaio de digestibilidade com o pé de milho seco com espigas em bovinos (Velloso, L.)
- Valor nutritivo de rações para prova de ganho de peso em bovinos (Velloso, L.)
- Valor nutritivo para bovinos, de restos da cultura de soja

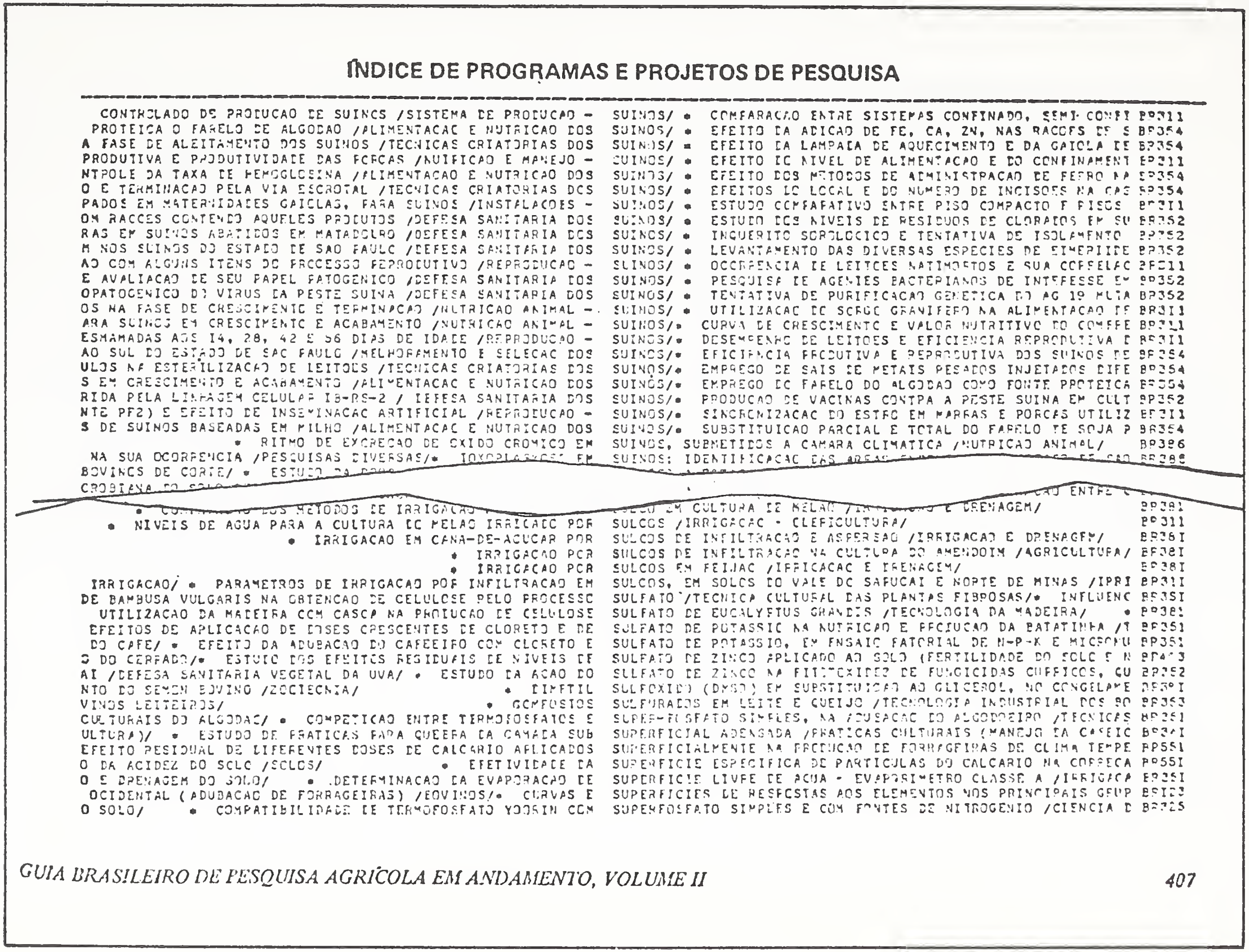
FIGURE 3. List of Research Workers (Including Bibliographical Data) The codes correspond to the institutions.

ÍNDICE ALFABÉTICO DE PESQUISADORES

FIGURE 4. Alphabetical Index of Research Institutions

ÍNDICE ALFABÉTICO DE INSTITUIÇÕES DE PESQUISA

FIGURE 5. Alphabetical Subject Index of Programs/Projects. The code to the right of the title indicates the institution where these are carried out.



ÍNDICE DE PROGRAMAS E PROJETOS DE PESQUISA

CONTROLADO DE PRODUCAO DE SUINOS /SISTEMA DE PRODUCAO -	SUINOS/ • COMPARACAO ENTRE SISTEMAS CONFINADO, SEMI-CONFI	BP311
PROTEICA O FARELO DE ALGODAO /ALIMENTACAO E NUTRICAO DOS	SUINOS/ • EFEITO DA ADICAO DE FE, CA, ZN, NAS RACOES DE S	BP354
A FASE DE ALEITAMENTO DOS SUINOS /TECNICAS CRIATORIAS DOS	SUINOS/ • EFEITO DA LAMPADA DE AQUECIMENTO E DA GAIOLA DE	BP354
PRODUTIVA E PRODUTIVIDADE DAS PORCAS /NUTRICAO E MANEJO -	SUINOS/ • EFEITO DO NIVEL DE ALIMENTACAO E DO CONFINAMENT	BP311
NTROLE DA TAXA DE HEMOGLOBINA /ALIMENTACAO E NUTRICAO DOS	SUINOS/ • EFEITO DOS METODOS DE ADMINISTRACAO DE FERRO NA	BP354
O E TERMINACAO PELA VIA ESCROTAL /TECNICAS CRIATORIAS DOS	SUINOS/ • EFEITOS DO LOCAL E DO NUMERO DE INCISOES NA CAS	BP354
PADOS EM MATERNIDADES GAIOLAS, PARA SUINOS /INSTALACOES -	SUINOS/ • ESTUDO COMPARATIVO ENTRE PISO COMPACTO E PISOS	BP311
OM RACOES CONTENDO AQUELES PRODUTOS /DEFESA SANITARIA DOS	SUINOS/ • ESTUDO DOS NIVEIS DE RESIDUOS DE CLORADOS EM SU	BP352
RAS EM SUINOS ABATIDOS EM MATADOURO /DEFESA SANITARIA DOS	SUINOS/ • INQUERITO SOROLOGICO E TENTATIVA DE ISOLAMENTO	BP352
M NOS SUINOS DO ESTADO DE SAO PAULO /DEFESA SANITARIA DOS	SUINOS/ • LEVANTAMENTO DAS DIVERSAS ESPECIES DE EIMERIIDE	BP352
AO COM ALGUNS ITENS DO PROCESSO REPRODUTIVO /REPRODUCAO -	SUINOS/ • OCORRENCIA DE LEITOES NATIMORTOS E SUA CORRELAC	BP311
E AVALIACAO DE SEU PAPEL PATOGENICO /DEFESA SANITARIA DOS	SUINOS/ • PESQUISA DE AGENTES BACTERIANOS DE INTERESSE EM	BP352
OPATOGENICO DO VIRUS DA PESTE SUINA /DEFESA SANITARIA DOS	SUINOS/ • TENTATIVA DE PURIFICACAO GENETICA DO AG 19 MUTA	BP352
OS NA FASE DE CRESCIMENTO E TERMINACAO /NUTRICAO ANIMAL -	SUINOS/ • UTILIZACAO DO SORGO GRANIFERO NA ALIMENTACAO DE	BR311
ARA SUINOS EM CRESCIMENTO E ACABAMENTO /NUTRICAO ANIMAL -	SUINOS/• CURVA DE CRESCIMENTO E VALOR NUTRITIVO DO COMERE	BP311
ESMAMADAS AOS 14, 28, 42 E 56 DIAS DE IDADE /REPRODUCAO -	SUINOS/• DESEMPENHO DE LEITOES E EFICIENCIA REPRODUTIVA D	BP311
AO SUL DO ESTADO DE SAO PAULO /MELHORAMENTO E SELECAO DOS	SUINOS/• EFICIENCIA PRODUTIVA E REPRODUTIVA DOS SUINOS DE	BP354
ULOS NA ESTERILIZACAO DE LEITOES /TECNICAS CRIATORIAS DOS	SUINOS/• EMPREGO DE SAIS DE METAIS PESADOS INJETADOS DIFE	BP354
S EM CRESCIMENTO E ACABAMENTO /ALIMENTACAO E NUTRICAO DOS	SUINOS/• EMPREGO DO FARELO DO ALGODAO COMO FONTE PROTEICA	BP354
RIDA PELA LINHAGEM CELULAR IB-RS-2 / DEFESA SANITARIA DOS	SUINOS/• PRODUCAO DE VACINAS CONTRA A PESTE SUINA EM CULT	BP352
NTE PF2) E EFEITO DE INSEMINACAO ARTIFICIAL /REPRODUCAO -	SUINOS/• SINCRONIZACAO DO ESTRO EM MARRAS E PORCAS UTILIZ	BP311
S DE SUINOS BASEADAS EM MILHO /ALIMENTACAO E NUTRICAO DOS	SUINOS/• SUBSTITUICAO PARCIAL E TOTAL DO FARELO DE SOJA P	BR354
• RITMO DE EXCRECAO DE OXIDO CROMICO EM	SUINOS, SUBMETIDOS A CAMARA CLIMATICA /NUTRICAO ANIMAL/	BP386
NA SUA OCORRENCIA /PESQUISAS DIVERSAS/• TOXOPLASMOSE EM	SUINOS: IDENTIFICACAO DAS AREAS [illegible]	BP388
BOVINOS DE CORTE/ • ESTUDO DA [illegible]		
CROBIANA DO SOLO [illegible]	[illegible] ENTRE [illegible]	
• [illegible] DOS METODOS DE IRRIGACAO [illegible]	[illegible] EM CULTURA DE MELAO /[illegible] E DRENAGEM/	BP381
• NIVEIS DE AGUA PARA A CULTURA DO MELAO IRRIGADO POR	SULCOS /IRRIGACAO - OLERICULTURA/	BP311
• IRRIGACAO EM CANA-DE-ACUCAR POR	SULCOS DE INFILTRACAO E ASPERSAO /IRRIGACAO E DRENAGEM/	BR361
• IRRIGACAO POR	SULCOS DE INFILTRACAO NA CULTURA DO AMENDOIM /AGRICULTURA/	BF381
• IRRIGACAO POR	SULCOS EM FEIJAO /IRRIGACAO E DRENAGEM/	BP381
IRRIGACAO/ • PARAMETROS DE IRRIGACAO POR INFILTRACAO EM	SULCOS, EM SOLOS DO VALE DO SAPUCAI E NORTE DE MINAS /IPRI	BP311
DE BAMBUSA VULGARIS NA OBTENCAO DE CELULOSE PELO PROCESSO	SULFATO /TECNICA CULTURAL DAS PLANTAS FIBROSAS/• INFLUENC	BP351
UTILIZACAO DA MADEIRA COM CASCA NA PRODUCAO DE CELULOSE	SULFATO DE EUCALYPTUS GRANDIS /TECNOLOGIA DA MADEIRA/ •	BP381
EFEITOS DE APLICACAO DE DOSES CRESCENTES DE CLORETO E DE	SULFATO DE POTASSIO NA NUTRICAO E PRODUCAO DA BATATINHA /T	BP351
DO CAFE/ • EFEITO DA ADUBACAO DO CAFEEIRO COM CLORETO E	SULFATO DE POTASSIO, EM ENSAIO FATORIAL DE N-P-K E MICRONU	BP351
O DO CERRADO/• ESTUDO DOS EFEITOS RESIDUAIS DE NIVEIS DE	SULFATO DE ZINCO APLICADO AO SOLO (FERTILIDADE DO SOLO E N	BP4?3
AI /DEFESA SANITARIA VEGETAL DA UVA/ • ESTUDO DA ACAO DO	SULFATO DE ZINCO NA FITOTOXIDEZ DE FUNGICIDAS CUPRICOS, CU	BP252
NTO DO SEMEN BOVINO /ZOOTECNIA/ • DIMETIL	SULFOXIDO (DMSO) EM SUBSTITUICAO AO GLICEROL, NO CONGELAME	BP381
VINOS LEITEIROS/ • COMPOSTOS	SULFURADOS EM LEITE E QUEIJO /TECNOLOGIA INDUSTRIAL DOS PO	BP353
CULTURAIS DO ALGODAO/ • COMPETICAO ENTRE TERMOFOSFATOS E	SUPER-FOSFATO SIMPLES, NA ADUBACAO DO ALGODOEIRO /TECNICAS	BP251
ULTURA)/ • ESTUDO DE PRATICAS PARA QUEBRA DA CAMADA SUB	SUPERFICIAL ADENSADA /PRATICAS CULTURAIS (MANEJO DA CASEIC	BP3?1
EFEITO RESIDUAL DE DIFERENTES DOSES DE CALCARIO APLICADOS	SUPERFICIALMENTE NA PRODUCAO DE FORRAGEIRAS DE CLIMA TEMPE	BP551
O DA ACIDEZ DO SOLO /SOLOS/ • EFETIVIDADE DA	SUPERFICIE ESPECIFICA DE PARTICULAS DO CALCARIO NA CORRECA	BP551
O E DRENAGEM DO SOLO/ • DETERMINACAO DA EVAPORACAO DE	SUPERFICIE LIVRE DE AGUA - EVAPORIMETRO CLASSE A /IRRIGACA	BP351
OCIDENTAL (ADUBACAO DE FORRAGEIRAS) /BOVINOS/• CURVAS E	SUPERFICIES DE RESPOSTAS AOS ELEMENTOS NOS PRINCIPAIS GRUP	BP1?3
O SOLO/ • COMPATIBILIDADE DE TERMOFOSFATO YOORIN COM	SUPERFOSFATO SIMPLES E COM FONTES DE NITROGENIO /CIENCIA D	BP325

GUIA BRASILEIRO DE PESQUISA AGRÍCOLA EM ANDAMENTO, VOLUME II 407

FIGURE 6. New Version of the Alphabetical Subject Index of Programs/Projects. The code to the right of the title gives access to complete data in the general reference list.

ACIDO-CIANIDRICO
-INTOXICACAO POR ACIDO-CIANIDRICO EM BOVINOS, CAUSADA PELA INGESTAO DE ALGAROBA (PROSOPIS-JULIFLORA-(SW)-DC.) ASSOCIADO COM A CANA-DE-ACUCAR (SACCHARUM-AFFICINARUM-L.) [ZOOTECNIA] 2BR.252.AF540-30]. 0001410

ANTI-VIA
-RELACAO ENTRE O ISOLAMENTO DE VIRUS-AFTOSO OU SEMEN DE TOUROS-DOADORES E A PESQUISA DO ANTICORPO ANTI-VIA NO SORO [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54140I. 0000075

ENTEROXINAS
-ESTUDO SOBRE DIARREIAS DOS ANIMAIS DOMESTICOS, ISOLAMENTO E IDENTIFICACAO DE AMOSTRAS DE ESCHIRICHIA-COLI, PRODUTORAS DE ENTEROXINAS [DEFESA SANITARIA ANIMAL; BOVINOS DE LEITE; 2BR.350.GN54030-]. 0000225

FEBRE-AFTOSA
-UTILIZACAO DA DIFUSAO EM AGAR NO DIAGNOSTICO DA FEBRE-AFTOSA [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54120I. 0000150
-SUSCEPTIBILIDADE DO CAMUNDONGO ADULTO AO VIRUS FEBRE-AFTOSA INOCULADO POR VIA INTRACEREBRAL [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54130I. 0000165

ISOLAMENTO
-TENTATIVA DE ISOLAMENTO DE VIRUS EM CULTURA DE TECIDOS DE MATERIAL DE MATADOURO E DE SEMEN DE BOVINO [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54020I. 0000030
-RELACAO ENTRE O ISOLAMENTO DE VIRUS-AFTOSO OU SEMEN DE TOUROS-DOADORES E A PESQUISA DO ANTICORPO ANTI-VIA NO SORO [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54140I. 0000075
-PESQUISA DE ANTICORPOS NEUTRALIZANTES, O VIRUS SYNCICIAL-RESPIRATORIO, EM SORO DE BOVINOS EM SAO PAULO. ISOLAMENTO DO VIRUS [DEFESA SANITARIA ANIMAL; BOVINOS DE LEITE; 2BR.350.GN54010I. 0000195
-ESTUDO SOBRE DIARREIAS DOS ANIMAIS DOMESTICOS, ISOLAMENTO E IDENTIFICACAO DE AMOSTRAS DE ESCHIRICHIA-COLI, PRODUTORAS DE ENTEROXINAS [DEFESA SANITARIA ANIMAL; BOVINOS DE LEITE; 2BR.350.GN54030-]. 0000225
-ISOLAMENTO E SELECAO DE ESTIRPES DE RHIZOBIUM [MICROBIOLOGIA; 2BR.IAI.AL54010I. 0002625

VIRUS
-TENTATIVA DE ISOLAMENTO DE VIRUS EM CULTURA DE TECIDOS DE MATERIAL DE MATADOURO E DE SEMEN DE BOVINO [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54020I. 0000030
-SUSCEPTIBILIDADE DO CAMUNDONGO ADULTO AO VIRUS FEBRE-AFTOSA INOCULADO POR VIA INTRACEREBRAL [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54130I. 0000165
-PESQUISA DE ANTICORPOS NEUTRALIZANTES, O VIRUS SYNCICIAL-RESPIRATORIO, EM SORO DE BOVINOS EM SAO PAULO. ISOLAMENTO DO VIRUS [DEFESA SANITARIA ANIMAL; BOVINOS DE LEITE; 2BR.350.GN54010I. 0000195

VIRUS-AFTOSO
-RELACAO ENTRE O ISOLAMENTO DE VIRUS-AFTOSO OU SEMEN DE TOUROS-DOADORES E A PESQUISA DO ANTICORPO ANTI-VIA NO SORO [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54140I. 0000075

FIGURE 7. Alphabetical Index of Research Workers

ALVES, M. DE F.	0002625
BARBOSA, H.P.	0011410
BARBOSA, H.P.	0011403
BEZERRA, T.G.	0011396
BRAGA, E.	0002640
BREMER GAONA, J.H.	0002610
BUENO, P.C.	0000105
CAMPEDELLI, O.	0000210
COQUEIRO, J.P.P.	0002565
COQUEIRO, J.P.P.	0002580
FENERICH, F.L.	0000180
FERNANDES, N.S.	0000090
GIORGI, W.	0000120
GONDIM, A.G.	0002595
GONDIM, A.G.	0002610
MUELLER, S.B.K.	0000030
OLIVEIRA, A.R. DE.	0000060
OLIVEIRA, A.R. DE.	0000135
OLIVEIRA, M.O.	0011417
PIEGAS, N.S.	0000015
PIEGAS, N.S.	0000045
TEIXEIRA FILHO, J.R.	0016142
TEIXEIRA FILHO, J.R.	0016149
TEIXEIRA FILHO, J.R.	0016156
TEIXEIRA FILHO, J.R.	0016163
TEIXEIRA FILHO, J.R.	0016170
VIANNA, W.D.	0000225
YSLA CHEE, E.W.	0002595
YSLA CHEE, E.W.	0002610
YSLA CHEE, E.W.	0002640

FIGURE 8. Alphabetical Index of Research Institutions

```
CENTRO DE CIENCIAS E TECNOLOGIA DA UNIVERSIDADE        0011396
CENTRO DE CIENCIAS E TECNOLOGIA DA UNIVERSIDADE        0011403
CENTRO DE CIENCIAS E TECNOLOGIA DA UNIVERSIDADE        0011410
CENTRO DE CIENCIAS E TECNOLOGIA DA UNIVERSIDADE        0011417
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ESCOLA SUPERIOR DE AGRONOMIA DO ESPIRITO SANTO.        0016142
ESCOLA SUPERIOR DE AGRONOMIA DO ESPIRITO SANTO.        0016149
ESCOLA SUPERIOR DE AGRONOMIA DO ESPIRITO SANTO.        0016156
ESCOLA SUPERIOR DE AGRONOMIA DO ESPIRITO SANTO.        0016163
ESCOLA SUPERIOR DE AGRONOMIA DO ESPIRITO SANTO.        0016170
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FACULDADE DE CIENCIAS AGRARIAS DO PARA. BELEM.         0002565
FACULDADE DE CIENCIAS AGRARIAS DO PARA. BELEM.         0002580
FACULDADE DE CIENCIAS AGRARIAS DO PARA. BELEM.         0002595
FACULDADE DE CIENCIAS AGRARIAS DO PARA. BELEM.         0002610
FACULDADE DE CIENCIAS AGRARIAS DO PARA. BELEM.         0002625
FACULDADE DE CIENCIAS AGRARIAS DO PARA. BELEM.         0002640
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INSTITUTO BIOLOGICO. SAO APULO. SP. (BR.352).          0000030
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000015
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000045
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000060
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000075
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000090
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000105
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000120
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000135
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000150
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000165
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000180
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000195
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000210
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).          0000225
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FIGURE 9. Index of Terminated and New Projects

NOVO*

-FORMACAO DE PAPULACAO-BASE EM GALINHAS (RED CORN- ISH-X-NEW HAMPSHIRE) PARA OBTENCAO DO FRANGO-DE-- CORTE REGIONAL [MELHORAMENTO DE AVES DOMESTICAS;- 2BR.141.AQ5402D]. 0002580

-PRODUCAO DE MATERIA SECA E PROTEINA BRUTA DE PAS- TAGENS EM VARZEA DO ESTUARIO DO RIO-AMAZONAS [NU- TRICAO ANIMAL; 2BR.141.BE5401D]. 0002640

-SISTEMA DE EXPLARACAO MISTA DE CAPRINOS E OVINOS EM PASTAGEMS CULTIVADAS E PASTAGENS NATURAIS [ZO- OTECNIA; 2BR.252.AF5401D]. 0011396

-EFEITO DA SUBSTITUICAO PROGRESSIVA DO FARELO DE ALGODAO POR VAGENS-DE-ALGAROBA (PROSOPIS-JULIFLO- RA-(SW)-DC), NA ALIMENTACAO DE RUMINANTES [ZOOTE- CNIA; 2BR.252.AF5402D]. 0011403

-INTOXICACAO POR ACIDO-CIANIDRICO EM BOVINOS, CAU- SADA PELA INGESTAO DE ALGAROBA (PROSOPIS-JULIFLO- RA-(SW)-DC.) ASSOCIADO COM A CANA-DE-ACUCAR (SAC- CHARUM-AFFICINARUM-L.) [ZOOTECNIA; 2BR.252.AF540- 3D]. 0011410

-CALCULO DE CUSTO-MINIMO PARA RACOES AVICOLAS COM INGREDIENTES REGIONAIS ATRAVES DE PROGRAMACAO-LI- NEAR [ZOOTECNIA ; 2BR.252.AF5404D]. 0011417

-EFEITOS DA FREQUENCIA DE CORTES, FERTILIZANTES N- ITROGENADOS E ORGANICOS NA COMPOSICAO E PRODUCAO DO CAPIM-GUATEMALA (TRIPSACUM-SP) [NUTRICAO ANIM- AL; 2BR.305.AB5405D]. 0016170

TERMINADO*

-PESQUISA DE ANTICORPOS INIBIDORES DE HEMAGLUTINA- CAO PARA REOVIRUS EM GADO BOVINO [DEFESA SANITAR- IA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK5403D]. 0000045

-ESTUDO DE EOSINOFILIA EM HELMINTOSE EXPERIMENTAL EM BEZERROS [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK5404D]. 0000060

-ACAO DE ANTIGENO INESPECIFICO SOBRE INFECCAO CRO- NICA [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK5406D]. 0000105

-ESTUDO DE PROTEINOGRAMA EM HELMINTOSE EXPERIMENT- AL EM BEZERROS [DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK5411D]. 0000135

-SUSCEPTIBILIDADE DO CAMUNDONGO ADULTO AO VIRUS F- EBRE-AFTOSA INOCULADO POR VIA INTRACEREBRAL [DEF- ESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.- GK5413D]. 0000165

-ESTUDOS SOBRE CRIPTOCOCUS [DEFESA SANITARIA ANIM- AL; BOVINOS DE LEITE; 2BR.350.GN5402D]. 0000210

-RACAS E HIBRIDOS DE FRANGO-DE-CORTE REGIONAL [ME- LHORAMENTO DE AVES DOMESTICAS; 2BR.141.AQ5401D]. 0002565

-5.AB5401D]. 0016142

FIGURE 10. Reference List (Including, for Each Project, the Name of the Research Worker(s), the Institution Responsible, the Title of the Project and Corresponding Program). The codes following the institution and the program title indicate, respectively, the institution and project code in the CARIS system.

```
0000075
SUGA, O.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
RELACAO ENTRE O ISOLAMENTO DE VIRUS-AFTOSO DO SE-
MEN DE TOUROS-DOADORES E A PESQUISA DO ANTICORPO
ANTI-VIA NO SORO (DEFESA SANITARIA ANIMAL; BOVIN-
OS DE CORTE; 2BR.350.GK54140).

0000090
FERNANDES, N.S.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
PESQUISA DE ELEMENTOS-MINERAIS EM TECIDO-ANIMAL
E TECIDO-VEGETAL (DEFESA SANITARIA ANIMAL; BOVIN-
OS DE CORTE; 2BR.350.GL54010).
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0000150
SUGA, O.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
UTILIZACAO DA DIFUSAO EM AGAR NO DIAGNOSTICO DA
FEBRE-AFTOSA (DEFESA SANITARIA ANIMAL; BOVINOS DE
CORTE; 2BR.350.GK54120).

0000165
SUGA, O.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
SUSCEPTIBILIDADE DO CAMUNDONGO ADULTO AO VIRUS F-
EBRE-AFTOSA INOCULADO POR VIA INTRACEREBRAL (DEF-
ESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.-
GK54130).

0000180
FENERICH, F.L.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
IDENTIFICACAO DAS ESPECIES DE EIMERIIDEOS DOS AN-
IMAIS DOMESTICOS (DEFESA SANITARIA ANIMAL; BOVIN-
OS DE CORTE; 2BR.350.GL54070).

0000195
RIBEIRO, L.O.C.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
PESQUISA DE ANTICORPOS NEUTRALIZANTES, O VIRUS S-
YNCICIAL-RESPIRATORIO, EM SORO DE BOVINOS EM SAO
PAULO. ISOLAMENTO DO VIRUS (DEFESA SANITARIA ANI-
MAL; BOVINOS DE LEITE; 2BR.350.GN54010).

0000210
CAMPEDELLI, O.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
ESTUDOS SOBRE CRIPTOCOCUS (DEFESA SANITARIA ANIM-
AL; BOVINOS  DE LEITE; 2BR.350.GN54020).

0000225
VIANNA, M.O.; SOUSA, J.F.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
ESTUDO SOBRE DIARREIAS DOS ANIMAIS DOMESTICOS, I-
SOLAMENTO E IDENTIFICACAO DE AMOSTRAS DE ESCHIRI-
CHIA-COLI, PRODUTORAS DE ENTEROXINAS (DEFESA SAN-
ITARIA ANIMAL; BOVINOS DE LEITE; 2BR.350.GN54030-
3.
```

TABLE 1. COMPARISON OF INITIAL SURVEY DATA AND FIRST UPDATING

Recorded Data	Initial Survey 1976/1977	1st Updating 1977/1978
Institutions	307	367
Research Workers	2,398	4,661*
Research Programs	1,025	1,379*
Research Projects	5,360	6,164*+

*Subject to slight revision due to late entries.

+Includes projects identified for the first time (new) and those which continue from last year (ongoing). This number does not include approximately 1,000 projects terminated during the period.

In its present stage of development, the BRACARIS system permits information retrieval in batch and the generation of SDI type outputs. Figure 11 is an example of a retrieval printout.

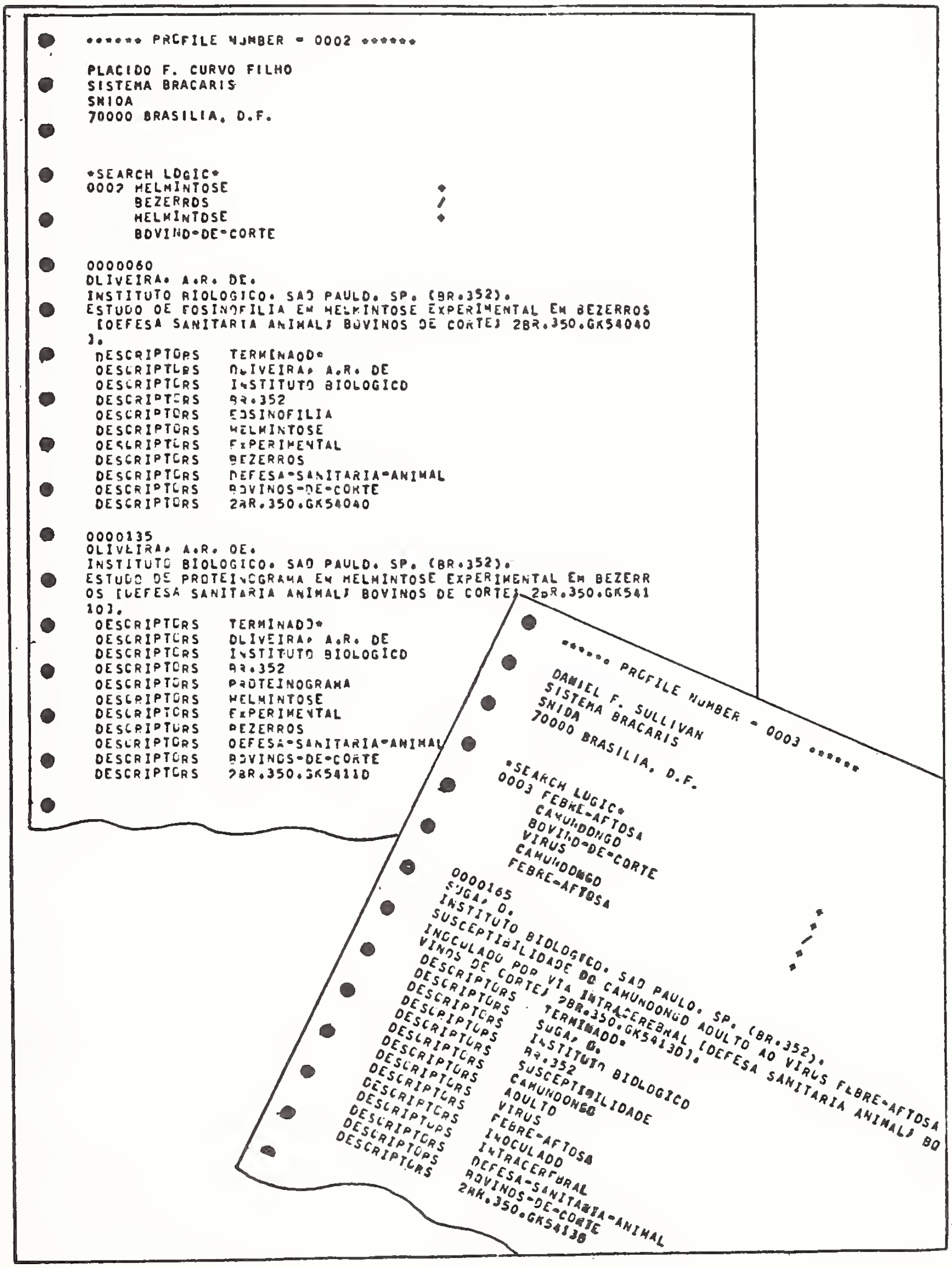
OUTLOOK FOR THE FUTURE

The record format adopted allows for rapid incorporation of data on disk files with defined structures (master file, inverted file, vocabularies, etc.) for purposes of implementing an interactive system of information retrieval.

At the time this paper was being prepared, a project was in progress with the National Council of Scientific and Technological Research (Conselho Nacional de Desenvolvimento Cíentifico e Tecnológico, CNPq) for a joint implementation of an online system.

Although it is difficult at the moment to name a date for the full operation of the entire system (due to delay in obtaining telephone lines for terminals and problems of availability of human and financial resources), it is hoped that in 1979 the data bases on current agricultural research in Brazil will be accessible by means of a terminal in the National Agricultural Library of Brazil.

FIGURE 11. An Example of Information Retrieval



```
****** PROFILE NUMBER = 0002 ******

PLACIDO F. CURVO FILHO
SISTEMA BRACARIS
SNIDA
70000 BRASILIA, D.F.


*SEARCH LOGIC*
0002 HELMINTOSE                              *
     BEZERROS                                /
     HELMINTOSE                              *
     BOVINO-DE-CORTE

0000060
OLIVEIRA, A.R. DE.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
ESTUDO DE EOSINOFILIA EM HELMINTOSE EXPERIMENTAL EM BEZERROS
 (DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK54040
).
 DESCRIPTORS   TERMINADO*
 DESCRIPTORS   OLIVEIRA, A.R. DE
 DESCRIPTORS   INSTITUTO BIOLOGICO
 DESCRIPTORS   BR.352
 DESCRIPTORS   EOSINOFILIA
 DESCRIPTORS   HELMINTOSE
 DESCRIPTORS   EXPERIMENTAL
 DESCRIPTORS   BEZERROS
 DESCRIPTORS   DEFESA-SANITARIA-ANIMAL
 DESCRIPTORS   BOVINOS-DE-CORTE
 DESCRIPTORS   2BR.350.GK54040

0000135
OLIVEIRA, A.R. DE.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
ESTUDO DE PROTEINOGRAMA EM HELMINTOSE EXPERIMENTAL EM BEZERR
OS (DEFESA SANITARIA ANIMAL; BOVINOS DE CORTE; 2BR.350.GK541
10).
 DESCRIPTORS   TERMINADO*
 DESCRIPTORS   OLIVEIRA, A.R. DE
 DESCRIPTORS   INSTITUTO BIOLOGICO
 DESCRIPTORS   BR.352
 DESCRIPTORS   PROTEINOGRAMA
 DESCRIPTORS   HELMINTOSE
 DESCRIPTORS   EXPERIMENTAL
 DESCRIPTORS   BEZERROS
 DESCRIPTORS   DEFESA-SANITARIA-ANIMAL
 DESCRIPTORS   BOVINOS-DE-CORTE
 DESCRIPTORS   2BR.350.GK54110
```

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****** PROFILE NUMBER = 0003 ******
DANIEL F. SULLIVAN
SISTEMA BRACARIS
SNIDA
70000 BRASILIA, D.F.

*SEARCH LOGIC*
0003 FEBRE-AFTOSA
     CAMUNDONGO
     BOVINO-DE-CORTE
     VIRUS
     CAMUNDONGO
     FEBRE-AFTOSA
0000165
SUGA, O.
INSTITUTO BIOLOGICO. SAO PAULO. SP. (BR.352).
SUSCEPTIBILIDADE DO CAMUNDONGO ADULTO AO VIRUS FEBRE-AFTOSA
INOCULADO POR VIA INTRACEREBRAL (DEFESA SANITARIA ANIMAL; BO
VINOS DE CORTE; 2BR.350.GK54130).
DESCRIPTORS   TERMINADO*
DESCRIPTORS   SUGA, O.
DESCRIPTORS   INSTITUTO BIOLOGICO
DESCRIPTORS   BR.352
DESCRIPTORS   SUSCEPTIBILIDADE
DESCRIPTORS   CAMUNDONGO
DESCRIPTORS   ADULTO
DESCRIPTORS   VIRUS
DESCRIPTORS   FEBRE-AFTOSA
DESCRIPTORS   INOCULADO
DESCRIPTORS   INTRACEREBRAL
DESCRIPTORS   DEFESA-SANITARIA-ANIMAL
DESCRIPTORS   BOVINOS-DE-CORTE
DESCRIPTORS   2BR.350.GK54130
```

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1. J. Robredo and P. F. Curvo Filho, "The BRACARIS Project as the Basis of the Brazilian Current Agricultural Research Information System," communication presented at the 9th Brazilian Congress and 5th Rio Grande Seminar on Library Science and Documentation, Porto Alegre, July 3-8, 1977; Y. S. Chastinet, P. F. Curvo Filho, and J. Robredo, "The Implementation of the Project UNDP/FAO/BRA/72/020 (National System of Agricultural Information and Documentation, SNIDA) and Some Aspects of Its Operational Decentralization in the State of São Paulo," communication presented at the 1st São Paulo Congress on Agronomy, São Paulo, September 5-9, 1977.

2. Y. S. Chastinet, P. F. Curvo Filho, and J. Robredo, *Guia Brasileiro de pesquisa agrícola em andamento (Projeto BRACARIS), vol. 1, Cadastro de instituições* (Brasília: EMBRATER/SNIR, 1977. Project UNDP/FAO/BRA/72/020 (National System of Agricultural Information and Documentation) DOC/TEC/77/018).

3. Y. S. Chastinet, P. F. Curvo Filho, and J. Robredo, *Guia Brasileiro de pesquisa agrícola em andamento (Projeto BRACARIS), vol. 2, Programas/Projetos* (Brasília: EMBRATER/SNIR, 1977. Project UNDP/FAO/BRA/72/020 (National System of Agricultural Information and Documentation) DOC/TEC/77/019).

4. Chastinet et al., *Guia . . . vol. 1.*

5. Chastinet et al., *Guia . . . vol. 2.*

INFORMATION ON ANIMAL HEALTH AND DISEASES IN THE HUNGARIAN NATIONAL RESEARCH INFORMATION CENTER

Peter Lázár and Gy. Mártyán*

In Hungary, a decree of the Council of Ministers provides for the national registration and processing of information on research and development projects and for the related research information service.

Since 1974 the registration of those research and development projects which exceed a certain expenditure estimate and time limit in the fields of natural sciences, technology, agrarian, medical, and social sciences has been compulsory. Compulsory registration is extended to the theses of authors wishing to acquire the academic degree of Candidate or Doctor of Sciences. The 1974 decree of the Council of Ministers extended the scope of subjects to be registered and that of compulsory reporting of data compared to the statutory rule of 1968 which had decreed the setting up of a National Registry for Technical Research. The 1974 decree makes it obligatory for all institutions to report their research and development projects on the one hand and to provide the Central Office of Statistics with the pertinent statistical data on the other.

The comparison of the research information data bank with the statistical information available makes it possible to coordinate research and to assess its value on a level adequate for the preparation for decision-making.

The system of registration of the research and development subjects is continuous, as both the beginning and end of the work have to be reported. The research and development subjects and the academic theses must be registered on standard forms which contain the most important data and a brief summary of the subject.

The Hungarian Central Technical Library and Information Center has been entrusted by the National Office of Technical Development to set up the national registry, data store, and information service on research and development projects. The data bank of the Hungarian Central Technical Library and Information Center includes information on research and development projects which can also be found in the relevant information centers of the various scientific and economic sectors. Research reports are not collected and stored centrally.

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The data bank distinguishes the projects (a) according to their managerial, organizational, or formal characteristics, and (b) according to their subject contents. This second feature is the more important one and is in fact of a determining nature from the aspect of both the control of research activities and the research information services provided.

The subject of the research projects is disclosed by means of the Universal Decimal Classification. This widely used international classification system makes the detailed analytical processing of research projects and theses possible. The subjects are classified by information specialists well versed in the classification system, using the forty-two volumes of the Hungarian version of the Universal Decimal Classification and the latest issues of the *Extensions and Corrections to the UDC*.

Before classification the registration cards are examined for their information content and, if necessary, supplemented with further information obtained from the registering institution. In the course of classification the revised and supplemented subject of registration is disclosed in full detail and all characteristic and supplementary data, equipment, procedures, etc. are given the appropriate UDC notations. Thus, for example, in the case of veterinary subjects UDC numbers are assigned not only to the disease and the method of diagnosis, but also to the conditions of examination, methods, ancillary tools of testing, etc. This quite often, of course, involves complex notations, but at the same time it opens the possibility of subject approach from several aspects and a certain reduction of the drawbacks attached to the linearity of the card catalog.

The correctness and uniformity of classification is insured by regular revision which extends to the consistency of the use of UDC numbers with special emphasis on the sequence of sub-classes within one UDC number and the proper use of new UDC numbers.

The Universal Decimal Classification has been successfully applied for the classification of veterinary subjects, since the greatly detailed medical classes and sub-classes, 611/618, can be applied reasonably to individual detailed concepts and distinctive refinements. Theoretically there are no limits for interlinking notations of the classes 619 (Veterinary Medicine), 611/618 (Medical Science/Human Medicine), 636 (Stock-breeding/Husbandry), and 639 (Game and Fish Management) thus providing a multifacted classification of the research projects. Nevertheless, the independent UDC numbers of 619 (Veterinary Medicine) are used only when the given subject is of a general nature, or when the description does not specify the animal. Otherwise the UDC numbers of 636 (Stockbreeding) and of 639 (Game and Fish Management) are attached to the UDC number or combination of numbers of 611/618 (Medical Science) and will thus uniquivocally represent the disease of a given animal, the diagnosis and therapy of the disease, etc.

Description of the classified registered subjects is adapted to the specifications of the registration cards. All data are recorded on conventional catalog cards bearing the appropriate UDC numbers. The catalog cards

are duplicated according to the number of UDC notations and are entered into the catalog, which is the basis of the information service according to subjects.

Subjects related to animal health, i.e. veterinary medicine, make up a considerable percentage of the research and development projects registered. The subjects reflect the problems of animal breeding and veterinary medicine in Hungary and examination of their distribution helps in the determination of the proper proportions between research and development.

Tha analysis of a four-year period of reporting on veterinary research projects has led to the following conclusions:

- o The animal species of pig, cattle, and poultry are dominant; the occurrence of sheep and of some small animals, such as rabbit or nutria, is rather low.

- o The therapy of infectious diseases of viral and bacterial origin in cattle, pigs, and poultry occurs in a high percentage; in the case of cattle and pig the incidence of diseases of non-infectious origin is also relatively high.

- o The volume of research and development work related to animal breeding and hygiene is also considerable. The research projects refer mainly to hygienic demands under the conditions of large-scale animal farming. The subjects concern methods for the removal of waste and manure and disinfection, with special attention to protection of the environment.

- o The number of research subjects dealing with the clinical pharmacological aspects of vaccine and immunotherapy of all animal species is quite considerable.

- o In veterinary surgery the study of classical surgical interventions has regressed according to the changed situation in animal breeding.

- o Of the non-infectious diseases the incidence of osteosynthetic disorders and of diseases of the motor organs is particularly high, and among them the treatment of the shin of beef has been dominant.

- o Research work on feeding, on the physiologic processes of digestion and the biochemistry of food is rather scarce, but it includes research related to weight gain under the conditions of large-scale animal farming, e.g. the applicability of antibiotics as food supplements.

- o There are also some meat enzymologic studies arising from the use of food supplements, e.g. antibiotics which test the quality of taste and flavor of meat as foodstuff.

- o These subjects are indirectly related to various laboratory and histological studies.

- A relatively large volume of research is concerned with poultry breeding under large-scale industrial conditions, particularly with the hygienic aspects and dangers of infectious diseases under the conditions of large-scale broiler-breeding.

- Ten percent of all registered research and development projects deals with young animals.

- Very extensive work is devoted to pharmacologic problems, that is, to the clinical testing of the physiological and toxicologic effects of drugs.

Summing up, we can say that

- The research information data bank reflects national research activities in the fields of animal hygiene and veterinary sciences.

- In Hungary the practice of organized animal health and veterinary sciences can look back upon a past of more than one hundred years. From the middle of the nineteenth century on, a well organized animal health and veterinary care and control network has been active in Hungary.

- In 1949 the Veterinary Medical Research Institute of the Hungarian Academy of Sciences was set up. In agreement with the national program for animal breeding it has carried out and coordinated national research and development in this field ever since.

- The percentage ratio of the volume of research in the fields of animal hygiene and veterinary medicine is satisfactory. The subjects of research are specially adapted to Hungarian conditions. The information content of the reports satisfies the demands for information and by means of a multifaceted approach meets the requirements of decision making in research and development.

- The research information system of the Hungarian Central Technical Library and Information Centre provides two types of information services: (1) selective dissemination of information, (2) occasional information on demand. Both services are at the disposal of research institutes, enterprises, ministries, and other interested parties.

- Information on research and development projects and on theses is not being published at present; thus it is available only at the national registry.

The plans for future development envisage the establishment of a computerized data bank to replace the present manual operations. This will improve the research information services. The publication of a periodical bulletin would provide wider publicity to the most recent research works. This trend of development fits into our institution's subject oriented concept of computerized information service supporting research and development in general.

SECTION V

ANIMAL PRODUCTION AND ECONOMIC DATA

Richard J. Crom,
Chairperson

INTRODUCTION

Disease cannot be controlled if the location and number of susceptible animals are not known. A decision to control cannot be made if data does not exist to calculate a cost-benefit ratio. Briefly stated, this is the basis for the inclusion of this section in the conference program.

Data gathering is a costly endeavor; thus good data are a luxury of the more affluent nations as part of more sophisticated management programs. An efficient national communications system is also a prerequisite.

Assignments for the papers in this section were made on a geographic basis. The discussion commences with economic data systems in the United States, followed by discussions focusing on the other developed countries of the world, the centrally planned countries, and the developing countries. Since the conference was fortunate to have Dr. Peter Ellis in attendance, he was asked to comment on European countries while Dr. Friend concentrated on the other countries with developed economies.

Overall, the papers reveal the existence of much more economic data than casual observation deems to exist.

Richard J. Crom,
Chairperson

LIVESTOCK DATA SYSTEMS IN THE UNITED STATES FOR ECONOMIC ANALYSIS

Gaylord Worden*

My task is to take a few minutes and help you become more knowledgeable about livestock data for the United States. I will break my discussion into five parts, the first being a general definition of livestock data for economic analysis and the others being brief descriptions of four major data systems.

When we think about economic analysis, we think about livestock, meat, milk, egg, and wool prices, about costs of producing livestock and livestock products, and about how those prices and costs will be changed by biologic and economic factors affecting the livestock industry. To analyze how prices and cost might change, one part of our data system must be good information about the supply of livestock and products including the inventory or existing stock of breeding herds and other animals kept primarily for producing meat, milk, or eggs; the production from these breeding herds; and imports of livestock or livestock products. It is necessary to have this supply information further broken into such detail as species—whether it is beef cows, milk cows, feeder cattle, or cattle on feed—and other detail like sex, age groups, weight groups, and geographic location. Another important factor is to have the statistics produced frequently and on a timely basis in order to have up to date, quality information.

A second major part of our economic data system must be good data on the use or disposition of livestock and livestock products. This might be data on marketings by farmers, on slaughter, on deaths, on meat consumption, on exports, and on changes in the inventory of breeding herds or laying flocks.

The third important part of our economic data system must be prices—both those received by the producer and the prices paid for items he buys to use in livestock production—and costs, as determined by these prices of purchased items and the production methods or practices.

The role of economic analysis then is to use the supply, price, and cost data to answer a wide variety of questions.

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*Gaylord Worden is Deputy Director for Economic Statistics, Office of Federal Statistical Policy and Standards, U.S. Department of Commerce.

We can think of a number of such economic questions that are of importance to this audience. What would be the impact on farm prices, food prices, and farmers' profits if the spread of a certain disease decreased broiler production by fifteen percent this year? What would be the expected change in production, use, and price of lamb if a new drug would lower production costs by ten percent? What would be the potential economic benefit of a research program that could increase the milk production per cow by five percent? And what were the benefits to farmers and consumers from a disease eradication program that increased the reproduction rate of beef cows by five percent?

The important thing to remember is that if an event—be it a disease, a drug, a research program, etc.—changes the cost or level of production, prices and consumption will also change. A careful economic analysis is needed then to estimate what the degree of change in the price or consumption might be and to make an accurate assessment of the economic impact of the event. It is not accurate, for example, to take a current market price and multiply it by a ten percent decrease in production and say that would be the dollar cost of a disease or the benefit of preventing that disease.

The major single source of such economic analysis is the Commodity Economics Division, Economics, Statistics and Cooperatives Service, USDA. They examine supply, use, price, and cost relationships on a continuing basis to estimate the economic impact of biological and economic events. Many other economists in universities and industry can also conduct this type of analysis among supply, use, price, and cost relationships.

MAJOR EXISTING DATA SYSTEMS

I would like to turn now to a brief description of four major data systems on U.S. livestock. We can generally characterize our situation under these four data systems as being very rich in long historical series of quality, detailed data but being relatively poor on machine readable data bases that are well documented and easily accessible for general use.

The major supplier of domestic livestock data is the Statistics Divisions, Economics, Statistics and Cooperatives Service, USDA. For those of you who don't keep up to date on organizational changes, you may know them better by their former title, The Statistical Reporting Service. They produce a large volume of weekly, monthly, quarterly, and annual statistical information for all types of livestock and livestock products. These data are collected through numerous surveys of farmers, buyers, and processors. Data by states, types of livestock, age groups, and weight groups are included in these statistics. Movement of cattle between states, estimates of livestock reproduction rates, estimates of annual death losses, average monthly prices received by producers, numbers of livestock placed on feed or slaughtered, and volume of livestock moving through selected markets each month are examples of data reported in addition to

basic inventory and production statistics.

The primary shortcoming of this very rich data system is that it is not generally available in an organized, machine readable data base. Current releases are available in machine readable form for a few days and of course published data exist for anyone who needs to create a lengthy historical data base by keypunching the relevant variables. More information on these important data can be obtained from the Secretary of the Crop and Livestock Reporting Board or the Chief of the Livestock Branch, Estimates Division, Economics, Statistics and Cooperatives Service, USDA.

The Economics Divisions of the Economics, Statistics and Cooperatives Service do have a machine readable data base of quarterly and annual data for conducting economic analysis. These historical time series include supply and price data from the first data system I just described, other sources of supply data such as Census Bureau data on imports, consumption estimates, and beginning and ending inventory estimates. The figures in this data base are for livestock products rather than head of livestock and are U.S. totals only for beef, pork, veal, lamb and mutton, total red meat, chickens, turkeys, eggs, and milk. Estimates of farmers' cash receipts from marketings of livestock and livestock products are also included. Although these data are in a well organized data retrieval and analysis system, no method for general direct public access has been developed yet. Additional information on this data system is available from the Outlook Coordinator, Economics, Statistics and Cooperatives Service, USDA.

The third data system providing data on livestock inventories and production is the Census of Agriculture data from the Bureau of the Census. This information is collected each five years to provide a uniform set of data for each county in the United States. In addition to some detail on types and weight classes of livestock, this data system also includes data on cash receipts from sale of livestock and livestock products and some selected livestock expenditure estimates. These data are available in published form for a long historical series and on machine readable tapes for 1969 and 1974. More information on access and use of these data is available from the Director, Agriculture Division, Bureau of the Census, U.S. Department of Commerce.

A fourth important data system is a cost of production data system developed and maintained by the Economics, Statistics and Cooperatives Service, USDA. From this data system, fairly detailed estimates of production costs can be generated by computer for different types of livestock, by different production systems, and for different geographic regions. Access to this data system can be obtained by writing the Director, Firm-Enterprise Data System, ESCS, USDA, Oklahoma State University, Stillwater, Oklahoma.

I hope these few minutes have helped you understand a little more about our important data systems for economic analysis and when economic analysis is needed. We have an abundance of quality data on livestock and I am

confident that more and more of it will become available in machine readable data base form in the future. Economic analysis can be a very useful tool as you plan and conduct your research and other programs.

FOREIGN TRADE DATA SYSTEMS

Robert Riemenschneider*

The Foreign Agriculture Service maintains livestock data bases for fifty-two foreign countries. The data are supplied by their agricultural attaches located in the respective countries or at neighboring posts.

The reporting instructions require the attaches to submit, in November, projections for animal inventories, meat production, trade, and consumption for the coming calendar year. These projections are updated semi-annually and in some cases quarterly along with revisions in historical data that have occurred in the interim. The sources for historical data are official government publications of the host country when available. If some information is not available, the attaches may use their own estimates based upon their personal knowledge and observances or estimates gleaned from industry and trade representatives.

The livestock inventory data card is shown in Figure 1. Beginning with the left-hand column an estimate for the calf, pig, or lamb crop is given. The beginning inventory is to be reported for a date as close to January 1 as possible and includes a separate estimate for breeding females. Figures for imports and exports of live animals follow but there is no differentiation as to whether these are young or mature animals or if they are intended for slaughter or breeding. Total slaughter is also segmented into female and young animal groupings. The final column, death loss, completes the supply and distribution format.

This is but one of four cards which the attaches submit. The other three contain supply and distribution information on meats and animal byproducts such as hides and skins, tallow, and offals.

The Foreign Agriculture Service began these new reporting formats in 1976. In September of 1978 they were able to publish nineteen years of data on total livestock numbers by class, i.e. cattle and calves, hogs, sheep, goats, and horses. Slaughter, meat production, trade, and consumption figures for each of the classes are also published. The agency intends to update this information annually and as they are able to fill in the historical series they intend to break down slaughter and animal inventories further into the components shown on the reporting instructions.

The reports of the individual attaches as well as the data cards are available upon request from the Foreign Agriculture Service reports

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*Robert Riemenschneider is with the Foreign Agriculture Service, USDA.

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FIGURE 1.

LIVESTOCK INVENTORY SUPPLY AND DISTRIBUTION

(In thousands of head)

(Circle one) November 10 / February 10 / May 10 / August 10 (Annual)

COUNTRY ______________________

YEAR	Calf crop	BEGINNING INVENTORY: Total	BEGINNING INVENTORY: Dairy cows	BEGINNING INVENTORY: Beef cows	Imports	Exports	SLAUGHTER: Cow	SLAUGHTER: Calf	SLAUGHTER: Other	SLAUGHTER: Total	Death loss	Ending inventory
CATTLE 4210000 19__												
19__												
19__												
19__												
	Pig crop.	Total	Sows		Imports	Exports	SLAUGHTER: Sow	SLAUGHTER: Other	SLAUGHTER: Total		Death loss	Ending inventory
SWINE 4610000 19__												
19__												
19__												
19__												
	Lamb crop	Total	Ewes		Imports	Exports	SLAUGHTER: Ewe	SLAUGHTER: Lamb	SLAUGHTER: Other	SLAUGHTER: Total	Death loss	Ending inventory
SHEEP 4410000 19__												
19__												
19__												
19__												
		Total		Imports for other than slaughter	Total imports	Exports	Total slaughter					
HORSES 4111100 19__												
19__												
19__												
19__												
		Total					Total slaughter					
GOATS 4510000 19__												
19__												
19__												
19__												

SEE INSTRUCTIONS ON REVERSE SIDE. COMMENTS AND DATA SOURCES ARE AS FOLLOWS:

officer. The information itself is computerized and will be released on tapes in the near future from the National Technical Information Service of the U.S. Commerce Department. The tapes are released twice a year and the cost of an annual subscription is about $100.

ANIMAL PRODUCTION AND ECONOMIC DATA SYSTEMS IN CANADA, JAPAN, AUSTRALIA, AND NEW ZEALAND

Reed E. Friend*

This paper provides some insights into animal production and economic data systems for Canada, Japan, Australia, and New Zealand. It is important to emphasize that no attempt has been made to achieve a comprehensive survey of data sources on the topic under discussion. That approach would result in unbearable repetition. What I have attempted to do is to identify a few major sources of information and give some indications of the relevant materials they contain. Realistically, a complete comprehension of animal production and economic data can probably be achieved only through a personal perusal of the reference documents. An expansion of the list of documents referred to in this paper would be required.

Brief statements will be made on the animal production and economic data systems of Canada, Japan, Australia, and New Zealand, in that order. (Statements on all countries except New Zealand are supplemented by detailed tables.) This will be followed by a short discussion of some relevant data from international sources and a few summary comments.

CANADA

A wide range of data on Canadian livestock is available primarily from two government agencies, Statistics Canada and Agriculture Canada.

Statistics Canada has the responsibility for promoting and developing an integrated system of social and economic statistics for the whole of Canada and the provinces.[1] The headquarters office is located in the capital, Ottawa, and regional offices are scattered throughout Canada. Although Canada's statistical service is centralized, some statistical operations are carried out in other departments of the central government as well as in the provinces. These various activities are coordinated to avoid duplication. Statistics Canada attempts to use the relevant statistics which are generated outside its own organization but a large

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*Reed E. Friend is Program Leader, Developed Countries Area, Foreign Demand and Competition Division, Economics, Statistics and Cooperatives Service, U.S. Department of Agriculture, Washington, D.C. The author gratefully acknowledges the assistance provided by Carol Bray, William Coyle, and Miles Lambert of the Developed Countries Program Area.

proportion of its information is collected directly through its own efforts.

The Agricultural Division of Statistics Canada has responsibility for nearly all of the collection of farm-based agricultural data. About fifty-five separate surveys are carried out each year. Many of the surveys are conducted by mail but an annual enumerative sample survey has become important in recent years. A Census of Agriculture is carried out every five years (the last one was taken in 1976) and provides the foundation for many of the annual farm data series available on Canada.

Table 1 provides selected information on Canadian livestock and livestock products. Cattle and poultry numbers are published semiannually; hog numbers are available quarterly. Data on cattle slaughter numbers, average carcass weight, and carcass grades are published periodically by Agriculture Canada. Statistics Canada publishes information on beef, pork, and poultry production and disappearance, stocks of livestock products, and trade.

Price data, economic parameters which delight the economist, are reasonably abundant. Information is available at different stages of the marketing chain—stockyard, wholesale, and retail level (Table 2). Much of the price information is available on a monthly basis and published by Statistics Canada. On-farm values are provided annually for cattle, hogs, and poultry.

In addition to the information listed in Tables 1 and 2, Statistics Canada also maintains one of the largest computerized data banks in Canada called CANSIM (Canadian Socio-Economic Information Management System). Initial work on this system started in 1966. Information from the system is available in computer printouts, cards, or tapes at specified prices. CANSIM contains over 250,000 time series and is updated on a daily basis. Major blocks of data are included on national accounts, prices, labor, manufacturing and primary industries, capital and finance, construction, merchandising and services, external trade, transportation, agriculture and food production, and health and welfare. The block of data on agriculture is in three groupings: crops, livestock and animal products, and farm income and prices. CANSIM contains an estimated 8,000 time series on livestock and animal products. Statistics Canada plans to extend the data base to include information from provincial government departments.*

JAPAN

Japan is preeminent in the collection and publication of detailed

*Additional information on CANSIM can be obtained from CANSIM, Current Economic Analysis Division, Statistics Canada, Ottawa K1A 0Z8 (613) 995-7406.

statistical data. This capability seems to extend to all sectors of the Japanese economy.

The Bureau of Statistics of the Office of the Prime Minister is engaged in the conduct and analysis of large scale statistical surveys to obtain basic information which is not collected by other ministries and government agencies. Well-equipped, modern tabulation facilities are available in the Bureau for assisting other government entities. The Training Institute of Statistical Personnel is also attached to the Office of the Prime Minister.

Japan's Ministry of Agriculture, Forestry and Fisheries has a Statistics and Information Division as its own central statistical organization for conducting various surveys. Offices are located in the different prefectures (states) and a large number of branch offices feed into the prefecture offices. The entire Statistics and Information Division organization is well staffed with qualified and trained workers.

Cattle, hog, and poultry numbers are published on February 1 of each year and pertain to the December 31 survey of the prior year (Table 3). The Ministry of Agriculture, Forestry and Fisheries (MAFF) also publishes information on the numbers of farm households producing cattle, hogs, and poultry. Annual information on infectious diseases and monthly data on prices are also compiled by MAFF. Chick hatchings are reported monthly by the Statistics and Information Division. Much of the information outlined above is available by prefecture on an annual basis. Trade data on live animals are published by the Japan Tariff Association on a monthly basis.

The availability and timing of selected information on beef, pork, poultry, and dairy products are presented in Table 4. Monthly information on the production and consumption of livestock products is compiled by MAFF. Wholesale prices or price indices are published either by MAFF or by the Bank of Japan while retail price information comes largely from the Office of the Prime Minister. An interesting set of statistical data, particularly from an economic perspective, is the yearly expenditures on selected livestock products by family income level published by the Office of the Prime Minister. This information offers the economist fertile data for analyzing income elasticity on a cross-sectional basis as well as on a time series basis. Detailed monthly trade data on livestock products, both exports and imports, are published by the Japan Tariff Association.

AUSTRALIA

The Australian Bureau of Statistics is the major entity in Australia concerned with the collection, compilation, and publication of official data relating to the livestock sector. Bureau offices are located in the six state capitals and in the Northern Territory with the central office

located in Canberra, the national capital. Although the state offices are responsible for the collecting, compiling, and publishing of statistics in each state, the central office coordinates the state data and publishes statistics for Australia.

Collection of livestock numbers by the Australian Bureau of Statistics is done annually by an Agricultural Census. This census is based on returns from all land holders of one acre or more who are engaged in agricultural pursuits (and also of less than one hectare if the farming operation is a land-intensive activity). Data are as of March 31 each year.

In addition to the data on livestock numbers, the annual publication titled *Livestock Statistics* reports on breeds of sheep (every three years), lambing statistics, rural holdings according to size of herds and flocks, slaughter numbers, and meat production (Table 5).

The Australian Bureau of Statistics is also responsible for the quarterly publication titled *Meat Statistics*. Detailed state information is provided on livestock slaughterings, meat production, exports, prices (at principal livestock markets), and the consumer price index (selected meats at major cities). Parts of these data are supplied to the Australian Bureau of Statistics by the Australian Bureau of Customs and the Australian Meat and Livestock Corporation.

Detailed monthly information is published by the Bureau on production of dairy products, egg settings, chick hatchings, poultry slaughterings, and export and import data. The Bureau receives monthly reports from various institutions to compile this information. For example, reports are received on fluid milk deliveries and quantities of milk used in factories in the manufacture of dairy products. The Bureau also receives monthly reports from commercial chicken hatcheries and commercial poultry slaughtering establishments. Detailed information on wool, Australia's most important agricultural commodity after grains in terms of value, is published annually in *Wool Production and Utilization* by the Australian Bureau of Statistics.

NEW ZEALAND

New Zealand farmers receive eighty-five percent of their farm cash receipts from the livestock sector. Consequently, a statistical tracking of developments in the livestock sector is of major concern to New Zealand.

The Department of Statistics in New Zealand is responsible for publication of the major statistical document on livestock and livestock products, the *Monthly Abstract of Statistics*. Livestock numbers are published twice annually, as of January 31 and June 30. Detailed meat production and consumption data are presented quarterly and yearly as are the number of animals slaughtered at meat export works and other abattoirs. The data on

slaughterings are supplied to the Department of Statistics by the Ministry of Agriculture and Fisheries. Detailed monthly and yearly production and consumption data on dairy products are provided to the Department of Statistics by the New Zealand Dairy Board.

Livestork products accounted for seventy-five percent of New Zealand's total exports in 1976-77. Detailed information on this trade—in terms of both value and volume—are reported in the *Monthly Abstract of Statistics* by the Department of Statistics.

Annual and monthly indices of wool prices for various grades of wool are also reported in the *Monthly Abstract of Statistics* from data supplied by the New Zealand Wool Board. Actual greasy wool tonnage, sale value, and average price per kilogram sold at eight sales centers in New Zealand are also reported. Yearly and quarterly price indices on sheep farming costs and dairy farming costs—items such as wages, animal health care, shearing expenses, breeding expenses, interest costs, and so forth—are reported in considerable detail. London yearly and quarterly wholesale prices for selected New Zealand livestock products—different classes and grades of wool, dairy products, lamb, and beef—are also reported in the *Monthly Abstract of Statistics.*

A monthly publication titled *New Zealand Meat Producer*, issued monthly by the New Zealand Meat Producers Board, contains rather detailed price information on lamb, mutton, and beef prices for the North Island. Provisional information is also included on export production slaughtering figures (carcasses) for three classes of sheep and six classes of cattle. Average carcass weights are also calculated. Meat export tonnage, by destination, is included for lamb, mutton, and beef and veal.

The Department of Statistics issues an annual report titled *Agriculture* which contains a substantial elaboration of livestock information. Livestock numbers, for eight classes of livestock, are given by region with sub-totals for the North Island and the South Island. Livestock slaughterings are given for the year ending September 30. Detailed regional information on commercial poultry, as of June 30, includes number of holdings, chickens for egg production, cockerels for breeding, chicken for meat, and selected other information. The report *Agriculture* also carries manifold information on beef cattle, dairy cattle, and hogs relative to age and sex and type of farm on which located. A generous amount of information is also available on sheep, by type of farm, including data on number of holdings where shearing is done, number of sheep shorn, and wool produced. Data on lambing percentages are available by statistical area and by counties.

INTERNATIONAL DATA SOURCES

The Organization for Economic Cooperation and Development (OECD), a twenty-four member country organization headquartered in Paris, compiles and

publishes information on economic factors, trade, and consumption data.* Canada, Japan, Australia, and New Zealand are members of this organization. Economic materials include the biannual *OECD Economic Outlook*, the annual *OECD Economic Surveys* for each member country, the *Quarterly National Accounts Bulletins*, the monthly *Main Economic Indicators*, and numerous other reports. Detailed trade data, including agricultural commodities, are also published by the OECD. As regards the food and agricultural area, and in particular livestock statistics, the OECD has in recent years published the following selected reports:

Forecasts of the Dairy and Beef Situation in 1979 and 1982 (August 1978)

Milk, Milk Products and Egg Balances in OECD Member Countries in 1963-1976 (May 1978)

Meat Balances in OECD Member Countries, 1963-1976 (April 1978)

Food Consumption Statistics, 1970-1975 (June 1978)

OECD's work program is extremely diverse and a number of additional reports relating to the livestock sector are available and listed in the *OECD Publications, 1978 Catalogue.*

The Food and Agriculture Organization of the United Nations (FAO) issues the *Production Yearbook*.** This yearly report contains world-wide country-by-country information on livestock numbers, slaughterings, average dressed carcass weight, and production data on meat, milk, selected dairy products, eggs, honey, wool, silk, and hides and skins. Among the many other data also published are prices of agricultural commodities (wholesale, import, and export) and the index number of prices received and prices paid by farmers. In the *1976 FAO Production Yearbook*, production data are given for a 1961-65 average, 1974, 1975, and 1976. The price data are for 1972 through 1976 while the price received-price paid index numbers are for a ten year period, 1967 through 1976.

FAO also publishes a *Trade Yearbook.* This report contains worldwide trade data on agricultural products including live animals, meat and meat products, eggs, dairy products, and other selected items. Data on commodities

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*The OECD headquarters is located at 2 rue Andre-Pascal, 75775 Paris Cedex 16, France. Sales agents are located in a number of countries including the United States (OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave. N.W., Washington, D. C. 20006).

**FAO headquarters are located in Rome. The 1976 yearbook is prepared in the Statistics Division of the Economic and Social Policy Department. FAO sales agents and booksellers are located in various areas of the world with the U.S. address as follows: UNIPUB, 650 First Avenue, P.O. Box 433, Murray Hill Station, New York, N.Y. 10016.

include the quantity and value of both imports and exports by country. In the *1976 FAO Trade Yearbook*, these data are given for 1974, 1975, and 1976. Country by commodity import-export value data are also included for the 1970 to 1975 period. FAO offers "standard tapes" containing data in computer-readable form for both the *Production Yearbook* and the *Trade Yearbook*.*

CONCLUSIONS

Each of the countries discussed—Canada, Japan, Australia, and New Zealand—publishes a generous quantity of information on livestock numbers, livestock production trade, prices, and other variables. The data are available on a yearly, quarterly, monthly, and sometimes weekly basis. Most of the national statistical information tends to be issued by only one or two agencies within each country, but other institutions may be involved in supplying essential data. Two international organizations—the OECD and FAO—also publish a significant amount of information on the economic activity, trade, and livestock sectors of numerous countries, including the four countries being discussed. In short, rather generous quantities of livestock production and economic data are available on Canada, Japan, Australia, and New Zealand.

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*Further information can be obtained by writing Computer Systems Branch, Management Services Division, Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.

REFERENCE

1. This information, along with some of the information in the tables on Canada, Japan, and Australia, was taken from Food and Agriculture Organization of the United Nations, *National Methods of Collecting Agricultural Statistics, Volume I, Asia and the Far East, European and North American Regions* (Rome, 1974).

TABLE 1. Canada: Selected Information

Item	Publication Title	Published by	Frequency
Cattle numbers	*Livestock and Animal Products, Statistics* Cat. No. 23-203	Statistics Canada Ottawa, Ontario Canada K1A0T6	Semiannually
Cattle slaughter	*Canada Livestock and Meat Trade Report*	Food Production and Marketing Branch, Agriculture Canada Ottawa, Ontario, K1A0L5	Annual and monthly
Beef stocks	*Stocks of Frozen Meat Products* Cat. No. 32-012	Statistics Canada	Annual and monthly
Production	*Estimates of Production and Disappearance of Meats* Cat. No. 32-220	Statistics Canada	Annual
Production and disappearance (beef and veal)	*Estimates of Production and Disappearance of Meats*	Statistics Canada	Annual
Per capita disappearance (beef and veal)	*Estimates of Production and Disappearance of Meats*	Statistics Canada	Annual
Carcass weight (beef)	*Canada Livestock and Meat Trade Report*	Agriculture Canada	Weekly
Grade of carcass (beef)	*Canada Livestock and Meat Trade Report*	Agriculture Canada	Weekly
Trade (beef and veal)	*Imports by Commodity* Cat. No. 65-007 *Imports by Countries* Cat. No. 65-006 *Exports by Commodity* Cat. No. 65-004 *Exports by Countries* Cat. No. 65-003	Statistics Canada	Annual and monthly

on Livestock and Livestock Products

Time Period	Subject Matter	Method
As of Jan. 1 and July 1	Number of cattle on farms nationally and provincially: bulls, cows (for milk and beef) yearling heifers (dairy and beef), steer calves	Voluntary, non-random mail-type survey. Measures of change in numbers are limited to Census benchmarks for current semiannual estimates.
Prior year and prior month	Cattle slaughtered at federally inspected establishments, nationally and provincially Cattle Calves	Reports from federal inspection stations
Prior year and prior month	Stock of frozen beef Bone in Bone out	Firms are required to report all stocks at the opening of the first business day of the month. Inventory is taken at the wholesale level.
Prior year	Output of meat and offals from livestock slaughtered in Canada	Statistics Canada generated data
Prior year	Production and disappearance of beef and veal in Canada	Statistics Canada generated data
Prior year	Per capita disappearance of beef and veal	Statistics Canada generated data
Prior week	Average carcass weights nationally and provincially Steers, bulls, and cows	Reports from slaughter stations
Prior week	Grade of carcasses: A; B; C-1, 2; D-1, 2, 3, 4, 5; E	Reports from slaughter stations
Prior year and prior month	Exports and imports of beef and veal and beef and veal products by commodity and country	Trade documents collected by Canada Customs

TABLE 1. Canada: Selected Information

Item	Publication Title	Published by	Frequency
Hog numbers	*Livestock and Animal Products Statistics* Cat. No. 23-203	Statistics Canada	Quarterly Jan. 1, April 1, July 1, Oct. 1
Hog slaughter	*Canada Livestock and Meat Trade Report*	Food Production and Marketing Branch, Agriculture Canada	Annual and monthly
Pork stocks	*Stocks of Frozen Meat Products*	Statistics Canada	Monthly
Production (pork)	*Estimates of Production and Disappearance of Meats*	Statistics Canada	Annual
Production and disappearance (pork)	*Estimates of Production and Disappearance of Meats*	Statistics Canada	Annual
Per capita disappearance (pork)	*Estimates of Production And disappearance of meats*	Statistics Canada	Annual
Grade of carcass (pork)	*Canada Livestock and Meat Trade Report*	Agriculture Canada	Weekly
Trade (hogs)	*Imports by Commodity* *Imports by Countries* *Exports by Commodity* *Exports by Countries*	Statistics Canada	Annual and monthly

Time period	Subject Matter	Method
Prior quarter	Number of farms, nationally and provincially. Market pigs under 3 months; market pigs over 3 months; breeding stock (over 6 months)	Information provided by sample of hog producers and voluntary non-random mail survey. Changes are then related to Census benchmarks. Sample is stratified by size of operator and province and large operators are followed up by telephone.
Prior month and prior year	Numbers slaughtered at federal inspection establishments, nationally and provincially	Compiled from reports from federal inspection stations
Prior month	Stocks of frozen pork products (national): hams, backs, loins, shoulders, butts	Firms required to report all stocks in their establishments or specially rented rooms as of opening of first business day of the month. Inventories taken at wholesale level.
Prior year	Output of meats and offals from hogs slaughtered in Canada (national)	Statistics Canada generated data
Prior year	Pork production and disappearance (national)	Statistics Canada generated data
Prior year	Per capita disappearance of pork (national)	Statistics Canada generated data
Prior week	Grades of carcasses: indexes 114, 113, 112, 110, 108, 107 105, 103, 102, 100, 98, 97 ...80, lights, fledglings, stags, sows	Reports from slaughter stations
Prior month and prior year	Exports and imports of hogs and pork products by commodity and country	Trade documents collected by Canada Customs

TABLE 1. Canada: Selected Information

Item	Publication Title	Published	Frequency
Poultry numbers	*Production of Poultry and Eggs* Cat.No. 23-202	Statistics Canada	Semiannually
Eggs	*Production of Eggs and Poultry* Cat. No. 23-003	Statistics Canada	Annual
Layers	*Production of Eggs and Poultry*	Statistics Canada	Monthly
Chick placements	*Production of Eggs and Poultry*	Statistics Canada	Monthly
Meat production (poultry)	*Production of Poultry and Eggs*	Statistics Canada	Annual
Eggs	*Production of Poultry and Eggs*	Statistics Canada	Annual and monthly
Per capita disappearance	*Production of Poultry and Eggs*	Statistics Canada	Annual
Egg-feed ratios	*Production of Poultry and Eggs*	Statistics Canada	Monthly
Stocks of meat (poultry)	*Stocks of Dairy and Frozen Poultry Products*	Statistics Canada	Monthly
Stock of eggs	*Stocks of Dairy and Frozen Poultry Products*	Statistics Canada	Monthly
Trade (poultry)	*Imports by Commodity* *Imports by Countries* *Exports by Commodity* *Exports by Countries*	Statistics Canada	Monthly

Time Period	Subject Matter	Method
As of Jan. 1 and July 1	Number of birds, nationally and provincially	Monthly sample surveys
Prior year	Production of eggs	Average number of layers times eggs per 100 layers
Prior month	Average number of layers	Total of estimated registered and non-registered flocks. Registered numbers are based on data from Canadian Egg Marketing Agency; non-registered from estimates based on survey data.
Prior month	Laying type pullet chick placements (nationally and provincially)	Agriculture Canada generated data
Prior year	Poultry meat supply and distribution: fowl, chicken, turkey	Statistics Canada generated data
Prior year and prior month	Egg supply and distribution nationally and provincially	Statistics Canada generated data
Prior year	Per capita disappearance of poultry meat and eggs	Statistics Canada generated data
Prior month	Egg-feed ratios, nationally	Statistics Canada generated data
Prior month	Stocks of frozen poultry meat nationally and provincially: chickens under 4 lbs., over 4 lbs.; turkeys over 10 lbs., under 16 lbs.; ducks; geese; additional detailed information	Data collected by mail questionnaires; inventories taken at manufacturers and wholesale levels; firms required to report all stocks held at opening of the first business day of the month.
Prior month	Stock of frozen eggs in storage nationally and provincially	Same as above
Prior month and prior year	Exports and imports of poultry and poultry products by commodity and country	Trade documents collected by Canada Customs

TABLE 2. Canada: Selected Information

Item	Publication Title	Published by	Frequency
Cattle value	*Livestock and Animal Products Statistics* Cat. No. 23-203	Statistics Canada Ottawa, Ontario Canada, K1A0T6	Annual
Beef cattle price	Same as above	Statistics Canada	Annual
Veal calves	Same as above	Statistics Canada	Annual and monthly
Steer prices	*Canada Livestock and Meat Trade Report*	Food Production and Marketing Branch, Agriculture Canada Ottawa, Ontario Canada, K1A0L5	Annual and monthly
Prices at principal stockyards (beef)	Same as above	Same as above	Annual, monthly and weekly
Beef wholesale price	Same as above	Same as above	Annual and monthly
	Same as above	Same as above	Annual and monthly
Beef retail price	*Consumer Prices and Price Indexes* Cat. No. 62-010	Statistics Canada	Annual and monthly
Beef and veal price indices	*Industry Price Indexes* Cat. No. 62-011	Statistics Canada	Annual and monthly

on Livestock and Livestock Product Prices

Time Period	Subject Matter	Method
Prior year	Value on farm: cattle, milk cows	Surveys of prices received by farmers in connection with agricultural activities
Prior year	Beef cattle: weighted average price per 100 lbs. at Toronto	Compiled by Agriculture Canada from provincial reporting centers' reports
Prior year and prior month	Veal calves, good and choice Weighted average prices at Montreal and Toronto	Same as above
Prior year and prior month	Steers: good, average price, Winnepeg and Toronto	Same as above
Prior year, month and week	Cattle and calf average prices at principal stockyards (breakdown too numerous to list here)	Same as above
Prior year and month	Average wholesale prices of A1 steer carcasses and sides in Ontario	Same as above
Prior year and month	Beef carcass average wholesale prices nationally and provincially: A1 steers 500-700 lbs.; D2 cows 500-700 lbs.	Same as above
Prior year and month	Beef retail prices of cuts in specified cities: sirloin, round steak, prime rib, blade roast (blade in and blade out), stewing beef, and ground beef	Generated as part of the Canadian CPI
Prior year and month	Industry selling price indices: beef, veal (fresh and frozen) on national and provincial basis	Prices are collected for new orders placed on 15th of each month; sales and excise taxes excluded

TABLE 2. Canada: Selected Information

Item	Publication Title	Published by	Frequency
Hog value	*Livestock and Animal Products Statistics* Cat. No. 23-203	Statistics Canada	Annual
Hog prices	Same as above	Statistics Canada	Annual
Hog prices	Same as above	Statistics Canada	Annual and monthly
Pork retail price	*Consumer Prices and Price Indexes*	Statistics Canada	Annual and monthly
Pork wholesale price	*Canadian Livestock and Meat Trade Report*	Agriculture Canada	Weekly
Pork price	*Industry Price Indexes* Cat. No. 62-011	Statistics Canada	Annual and monthly
Poultry value	*Production of Poultry and Eggs* Cat.No. 23-202	Statistics Canada	Annual
Egg value	Same as above	Statistics Canada	Annual
Egg prices	Same as above	Statistics Canada	Annual
Price indices (poultry)	*Industry Price Indexes*	Statistics Canada	Annual and monthly

Time Period	Subject Matter	Method
Prior year	Pigs: value on farm nationally and provincially Market pigs under 3 months, over 3 months; breeding stock (over 6 months)	Statistics Canada surveys of prices received by farmers in connection with agricultural activities
Prior year	Price per 100 pounds at Toronto	Compiled by Agriculture Canada from provincial reporting center's reports
Prior year and month	Weighted average price of index 100 grade hogs (Winnipeg, Toronto, Saskatoon, Calgary and Edmonton	Same as above
Prior year and month	Retail prices of cuts in specified cities	Generated as part of the Canadian CPI
Prior week	Wholesale dressed pork prices at major trading centers, Quebec, Ontario	Compiled by Agriculture Canada from provincial reporting center reports
Prior year and month	Industry selling price indices nationally and provincially: pork, fresh and frozen; bellies; ham; butts; picnics; bacon	Prices are collected for new orders placed on 1st of each month, sales and excise taxes excluded
Prior year	Value of birds produced: turkey, fowl, chicken	Surveys of prices received by farms in connection with agricultural activities
Prior year	Value of eggs produced	Monthly survey
Prior year	Average value of all eggs produced for consumption or manufacturing	Monthly survey
Prior year and month	Industry selling price indices for poultry and poultry products	Prices are collected for new orders placed on the 15th of each month, sales and excise taxes excluded

TABLE 3. Japan: Selected Information

Item	Publication	Published by	Frequency
Cattle numbers	*Statistical Yearbook of MAFF*	Statistics and Information Dept., Ministry of Agriculture, Forestry and Fisheries (MAFF), 1-2-1 Kasumiguseki Chiyada-ku, Tokyo	Published annually on February 1
Cattle prices	*Monthly Statistics of MAFF*	Statistics and Information Dept. MAFF	Monthly
Imports of live cattle	*Japan Exports and Imports*	Japan Tariff Association Jibiki Daini Bldg. 4-7-8 Kehji-Mathi Chiyada-ku Tokyo	Monthly
Exports of live cattle	Same as above	Same as above	Monthly
Farm households raising cattle, by prefecture	*Statistical Yearbook of MAFF*	MAFF	Published annually on February 1
Herd bulls, by breed	Same as above	MAFF	Same as above
Infectous diseases, cattle	Same as above	MAFF	Same as above
Hog numbers	Same as above	MAFF	Same as above

Time Period	Subject Matter	Method
As of December 31	Number of cattle raised 1) Milk cows a) under 2 years b) over 2 years 2) Beef cattle a) Japanese beef cattle b) milk cows for beef	Annual Census of Agriculture
Prior month	Prices received by farmers 1) Dairy beef a) heifers b) bulls 2) Beef cattle a) heifers b) bulls	Monthly survey
Prior month	Imports of live cattle 1) Live bovine other than buffaloes for breeding 2) Live bovine greater than 300 kg. in weight 3) Live bovine less than 300 kg. in weight 4) Live bovine not elsewhere specified	Import declaration
Prior month	Exports of live animals Live bovine for feeding purposes	Export declaration
As of December 31	Farm households raising cattle, by prefecture 1) Dairy cattle a) under 2 years b) over 2 years 2) Beef cattle a) female, i) less than 2 years, ii) more than 2 years b) males, i) less than 2 years, ii) more than 2 years	Annual Census of Agriculture
As of December 31	Number of herd bulls, by breed	Same as above
Prior year	Incidence of infectious diseases, by disease and prefecture	Same as above
Prior year	Number of hogs raised: 1) total hogs; 2) sows for breeding	Same as above

TABLE 3. Japan: Selected Information

Item	Publication	Published by	Frequency
Hog prices	*Monthly Statistics of MAFF*	MAFF	Monthly
Imports of live hogs	*Japan Exports and Imports*	Japan Tariff Association	Monthly
Farm households raising hogs, by prefecture	*Statistical Yearbook of MAFF*	MAFF	Published annually on February 1
Farm households raising hogs, by size of operation	Same as above	MAFF	Published annually on February 1
Infectious diseases in hogs	Same as above	MAFF	Same as above
Poultry numbers	Same as above	MAFF	Same as above
Poultry prices	*Monthly Statistics of MAFF*	MAFF	Monthly
Imports of live poultry	*Japan Exports and Imports*	Japan Tariff Association	Monthly
Exports of live poultry	Same as above	Same as above	Monthly
Households raising poultry	*Statistical Yearbook of MAFF*	MAFF	Annual
Chick hatchings	*Monthly Statistics of MAFF*	MAFF	Monthly
Infectious diseases in poultry	Same as above	MAFF	Annual

Time Period	Subject Matter	Method
Prior month	Prices received by farmers 1) hogs 2) feeder pigs	Monthly survey
Prior month	Imports of live hogs 1) for breeding purposes 2) less than 50 kg. per head 3) not elsewhere specified	Import declaration
As of December 31	Farm households raising hogs, by prefecture 1) total households 2) total number of hogs 3) under 6 months 4) six months or over, a) for breeding purposes, b) other	Annual Census of Agriculture
As of December 31	Farm households raising hogs, by size of operation, by prefecture	Annual Census of Agriculture
Prior year	Incidence of infectious diseases by type of disease and prefecture	Same as above
As of December 31	Number raised by prefecture: 1) layers, a) no. of households, b) total, i) less than 6 months, ii) more than 6 mos. 2) broilers, a) number of households, b) total number of broilers	Same as above
Prior month	Prices received by farmers: 1) broilers, 2) culled hens	Monthly survey
Prior month	Imports of live poultry: 1) less than 185 grams, 2) more than 185 grams	Import declaration
Prior month	Exports of live poultry: 1) less than 185 grams, 2) more than 185 grams	Export declaration
As of December 31	Households raising layers and broilers by size (no. of animals) and prefecture	Census of Agriculture
Prior month	Number of chicks artificially hatched and fed by prefecture, 1) layers, 2) broilers	Monthly survey
As of December 31	Incidence of infectious diseases by disease and prefecture	Census of Agriculture

TABLE 4. Japan: Selected Information or

Item	Publication	Published by	Frequency
Beef and veal production	*Monthly Statistics of MAFF*	Statistics and Information Dept., Ministry of Agriculture, Forestry and Fisheries (MAFF), 1-2-1 Kasumiguseki Chiyada-ku, Tokyo	Monthly
Wholesale price	Same as above	MAFF	Monthly
Whole price indices	*Wholesale Price Indices*	Statistics Dept. Bank of Japan Tokyo	Monthly
Retail prices	*Monthly Statistics of Japan*	Bureau of Statistics, Office of Prime Minister	Monthly
Yearly purchases	*Annual Report of the Family Income and Expenditure Survey*	Same as above	Annual
Imports	*Japan Exports and Imports*	Japan Tariff Association	Monthly
Exports	Same as above	Same as above	Monthly
Beef consumption	*Statistical Yearbook of MAFF*	MAFF	Annual
Pork consumption	*Monthly Statistics of MAFF*	MAFF	Monthly
Processed meat products	Same as above	MAFF	Monthly
Wholesale price	*Wholesale Price Indices*	Bank of Japan	Monthly
Retail price	*Monthly Statistics of MAFF*	MAFF	Monthly

Time Period	Subject Matter	Method
Prior month	Production of beef and veal 1) Beef a) from beef cattle b) from milk cows 2) Veal a) beef calves b) milk calves	Monthly survey
Prior month	Wholesale price of beef, dressed carcass, in various cities	Monthly survey
Prior month	Wholesale price indices of imported and domestic beef	Monthly survey
Prior month	Retail price of beef in Tokyo	Monthly survey
Prior year	Yearly expenditures, quantities and unit prices of beef (100 grams) by income level	Annual survey
Prior month	Imports of beef: 1) Fresh or chilled, a) bone out, b) bone in; 2) Frozen, a) bone out, b) bone in	Import declaration
Prior month	Exports of beef: 1) Bone in, fresh, chilled or or frozen, 2) Beef not elsewhere specified	Export declaration
Prior year	Per capita consumption of beef	FAO formula
Prior month	Production of pork	Monthly survey
Prior month	Production of processed meat products: 1) Ham, a) loin, b) pressed; 2) Bacon, 3) Sausage	Monthly survey
Prior month	Wholesale price index: 1) Pork, 2) Imported pork, 3) ham, 4) Sausage	Monthly survey
Prior month	Retail price of ham and sausage, Tokyo and Osaka	Monthly survey

TABLE 4. Japan: Selected Information on

Item	Publication	Published by	Frequency
Retail price (pork)	*Monthly Statistics of Japan*	Office of the Prime Minister	Monthly
Annual expenditure (pork)	*Annual Report of the Family Income and Expenditure Survey*	Same as above	Annual
Imports (pork)	*Japan Exports and Imports*	Japan Tariff Association	Monthly
Exports (pork)	Same as above	Same as above	Monthly
Pork consumption	*Statistical Yearbook of MAFF*	MAFF	Annual
Egg production	*Monthly Statistics of MAFF*	MAFF	Monthly
Poultry meat production	Same as above	MAFF	Monthly
Wholesale price indices	*Wholesale Price Indices*	Bank of Japan	Monthly
Retail price (poultry)	*Monthly Statistics of Japan*	Office of the Prime Minister	Monthly
Annual expenditure (poultry)	*Annual Report of the Family Income and Expenditure Survey*	Same as above	Annual
Imports (poultry)	*Japan Exports and Imports*	Japanese Tariff Association	Monthly
Exports (poultry)	Same as above	Same as above	Monthly
Consumption (poultry)	*Statistical Yearbook of MAFF*	MAFF	Annual
Milk production	*Monthly Statistics of MAFF*	MAFF	Monthly
Milk products	Same as above	MAFF	Monthly

Beef, Pork, Poultry, and Dairy Products (cont'd.)

Time Period	Subject Matter	Method
Prior month	Retail price in Tokyo 1) Pork, 2) Ham, 3) Sausage	Monthly survey
Prior year	Annual expenditure by income group 1) Pork, 2) Ham, 3) Sausage, 4) Bacon	Annual survey
Prior month	Imports of 1) pig carcasses, 2) pork fresh, chilled, or frozen, 3) internal organs of pigs	Import declaration
Prior month	Exports of ham, bacon, and other meats of domestic swine	Export declaration
Prior year	Per capita consumption of pork	FAO formula
Prior month	Hen egg production	Monthly survey
Prior month	Total shipment of poultry: Broilers only, a) number, b) weight	Monthly survey
Prior month	Wholesale price indices: 1) Chicken, 2) Eggs	Monthly survey
Prior month	Retail price: 1) Chicken, 2) Hens' eggs	Monthly survey
Prior year	Annual expenditure by income group: 1) Chicken, 2) Eggs	Annual survey
Prior month	Imports of 1) fowl, fresh, chilled or frozen, 2) turkeys, fresh, chilled or frozen	Import declaration
Prior month	Exports of 1) poultry and edible offals (except livers), fresh, chilled, or frozen, 2) poultry livers	Export declaration
Prior year	Per capita consumption of chicken and eggs	FAO formula
Prior month	Milk production: 1) Fluid milk, 2) Manufacturing milk	Monthly survey
Prior month	Production of milk products (11 milk products are listed)	Monthly survey

TABLE 4. Japan: Selected Information on

Item	Publication	Published by	Frequency
Wholesale price (milk)	*Monthly Statistics of MAFF*	MAFF	Monthly
Wholesale price indices (milk)	*Wholesale Price Indices*	Bank of Japan	Monthly
Retail price (milk)	*Monthly Statistics of Japan*	Office of the Prime Minister	Monthly
Annual expenditures (milk)	*Annual Report of the Family Income and Expenditure Survey*	Office of the Prime Minister	Annual
Imports (milk)	*Japan Exports and Imports*	Japanese Tariff Association	Monthly
Exports (milk)	Same as above	Same as above	Monthly
Per capita consumption (milk)	*Statistical Yearbook of MAFF*	MAFF	Annual

Time Period	Subject Matter	Method
Prior month	Wholesale prices (Tokyo and Osaka): 1) Fresh milk, 2) Powdered milk, 3) Butter	Monthly survey
Prior month	Wholesale price indices: 1) Fluid milk, 2) Condensed milk, 3) Powdered milk, 4) Yogurt, 5) Butter, 6) Cheese, 7) Imported cheese	Monthly survey
Prior month	Retail prices in Tokyo: 1) Powdered milk, 2) Fresh milk, 3) Butter, 4) Cheese	Monthly survey
Prior year	Annual expenditures by income level: 1) Fresh cows' milk, 2) Powdered milk, 3) Butter, 4) Cheese	Annual survey
Prior month	Imports of 1) Evaporated and condensed milk, 2) Powdered milk, 3) Whey, 4) Butter, 5) Processed cheese, 6) Cheese curd	Import declaration
Prior month	Exports of 1) Whey, 2) Powdered milk, 3) Evaporated and condensed milk, 4) Milk and cream, 5) Butter, 6) Cheese and curd	Export declaration
Prior year	Per capita consumption of 1) milk, 2) milk products	FAO formula

TABLE 5. Australia: Selected Information

Publication	Item	Time Period
Livestock Statistics (Annual) Australian Bureau of Statistics Canberra, Australia	Cattle numbers	As of March 31
	Sheep numbers	As of March 31
	Pig numbers	As of March 31
	Poultry numbers	As of March 31
(Every 3 years; last year available is 1977)	Breeds of sheep	As of March 31

Subject Matter	Method
Cattle 1) Milk a) Bulls 1 year and over used for service b) Bull calves under 1 year intended for service c) Cows in milk and dry d) Heifers 1 year and over e) Heifer calves under 1 year f) House cows and heifers g) Total 2) Meat a) Same as a) above b) Same as b) above c) Cows and heifers 1 year and over d) Heifer calves under 1 year e) Other calves under 1 year f) Other calves 1 year and over g) Total	Agricultural Census based on returns by all land holders of one hectare or more who are engaged in agricultural pursuits and also of less than one hectare if it is a land intensive activity.
Sheep 1) Rams (1 year and over) 2) Breeding ewes (1 year and over) 3) Other ewes (1 year and over) 4) Wethers (1 year and over) 5) Lambs and hoggets (under 1 year) 6) Total	Same as above
Pigs 1) Boars 2) Breeding sows and gilts intended for breeding 3) Other pigs (including suckers, weaners, growers, etc.) 4) Total	Same as above
Poultry 1) Hens and pullets for egg production Meat strain chickens (broilers) 2) Total 3) Ducks 4) Turkeys 5) Other poultry 6) Total, all poultry	Same as above
Breeds of sheep (too detailed to present here)	Same as above

TABLE 5. Australia: Selected Information

Publication	Item	Time Period
Livestory Statistics (Annual) Australian Bureau of Statistics Canberra, Australia	Lambing	As of March 31
	Rural holdings with livestock	As of March 31
	Value and production of livestock	July-June year
	Slaughter numbers	July-June year
	Meat production	July-June year
	Poultry slaughter	July-June year
	Poultry meat production	July-June year
	Production and use of milk	July-June year
	Production of other livestock products	July-June year
	Wool production	July-June year
Meat Statistics (Quarterly: March, June, Sept., Dec.)	Livestock slaughterings	Annual and monthly

Subject Matter	Method
Lambing 1) Number of breeding ewes at beginning of season 2) Ewes intended to mate 3) Ewes actually mated 4) Lambs marked 5) Percentage of lambs marked to breeding ewes actually mated	Agricultural Census based on returns by all land holders of one hectare or more who are engaged in agricultural pursuits and also of less than one hectare if it is a land intensive activity
Rural holdings classified according to size of livestock herds and flocks (details not presented here)	Same as above
Gross value and production of livestock slaughterings and livestock products (details not presented here)	Same as above
Livestock numbers slaughtered (cattle, calves, sheep, lambs, pigs)	Same as above
Production of meat by type, excluding poultry (beef, veal, mutton, lamb, pigmeat, total)	Same as above
Poultry slaughtered (chickens, other fowl, ducks and drakes, turkeys)	Same as above
Production of poultry meat (chickens, other fowl, ducks and drakes, turkeys, all poultry)	Same as above
Production and utilization of whole milk (factory butter, non-processed cheese, processed milk products, other purposes, total)	Based on factory and State Milk Board data
Production of other livestock products (honey, beeswax, eggs)	Data for eggs from the Australia Egg Board and the Egg Marketing Board of New South Wales
Shorn wool production (sheep and lambs shorn wool production, average fleece weight)	Agricultural Census
Livestock slaughterings Cattle (bulls, bullocks, steers, cows, heifers, calves) Sheep	Monthly collection of data from abattoirs, etc., including estimation of animals slaughtered on farms

TABLE 5. Australia: Selected Information

Publication	Item	Time Period
Australian Bureau of Statistics		
Data by states except for export data	Meat production	Annual and monthly
	Canned meat production	Annual and monthly
	Bacon and ham production	Annual and monthly
	Exports	Annual and monthly
	Stocks	Annual and monthly
	Prices	Annual and monthly
	Consumer price index Index numbers for meat sub-groups	Annual and monthly
Dairying and Dairy Products (Annual) Australian Bureau of Statistics	Selected items	Annual and monthly
Milk Statistics (Monthly) Australian Bureau of Statistics	Production of dairy products	Prior month

Subject Matter	Method
Lambs Pigs	and meat produced from them, but only for animals killed for human consumption
Meat production (divided into beef, veal, mutton, lamb, and total meat)	Same as above
Canned meat production (including bacon and ham)	Same as above
Bacon and ham production (bone in and bone out)	Same as above
Exports of fresh, frozen, and processed meats (bone in and bone out) (Detailed list not presented here)	Same as above
Stocks of frozen meat: beef and veal, mutton, lamb, pork	From Australian Meat and Livestock Corporation data
Average monthly prices of principal Australian livestock markets (separate data shown for yearling beef, ox, cow, mutton, lamb, and pigs)	From estimates of state representatives of the Australian Meat and Livestock Corporation
Consumer price index (by major cities): beef and veal, mutton and lamb, pork	By ABS, collected by state
Data presented in this publication is basically a recap of data found in other publications which apply to the dairy industry. Information is presented on such items as production and utilization of butter, bulk butter graded for export, butter stocks, production and utilization of cheeses, cheese graded for export, exports and imports of cheese, cheese stocks, gross value of dairy products, and butter and cheese sales.	Data compiled from the same sources as for *Livestock Statistics*, *Milk Statistics*, and *Exports of Major Commodities by Country*
Production of dairy products: whole milk for all purposes, factory butter, non-processed cheese, processed milk products, whole milk for human consumption	Data gathered "mainly from returns of fluid milk supplied to milk authorities for domestic consumption and from details of actual and derived quantities of milk used in factories in the manufacture of dairy products."

TABLE 5. Australia: Selected Information

Publication	Item	Time Period
Chick Hatching and Poultry Slaughterings, Australia (Monthly) Australian Bureau of Statistics	Number of eggs set	Prior month
	Poultry slaughter	Prior month
	Chickens hatched	Prior month
Wool Production and Utilization (Annual) Australian Bureau of Statistics	Selected items	Prior year
Exports of Major Commodities by Country (Monthly) Australian Bureau of Statistics	Selected items	Prior month
Imports of Major Commodities by Country (Monthly) Australian Bureau of Statistics	Selected items	Prior month

Subject matter	Method
Number of eggs set in commercial hatcheries: meat strains, egg strains	Returns submitted by commercial chicken hatcheries and by commercial poultry slaughtering establishments
Poultry slaughtered for human consumption: Chickens slaughtered: number, dressed weight Other poultry slaughtered (not given by state) Other fowl and turkeys (number and dressed weight) Ducks and drakes (number and dressed weight)	Same as above
Chickens hatched in commercial hatcheries (divided into 4 groupings based on intended use)	Same as above
Details on various types of wool (greasy and slipe, scoured and carbonised, tops) are given; summaries of the data appear in other publications already listed here	Agricultural Census and data from wool markets and the wool industry and calculations based on these data
Selected items include butter, cheese, hides, skins, meats (various types), milk and cream, and wool (various classifications)	Compiled from "information contained in export outlines submitted by exporters or their agents to the Bureau of Customs as required by the Customs Act"
Selected items include live animals, meat and meat preparations, dairy products and eggs, hides and skins, and animal fats and oils	Same as above (except for importing countries)

LIVESTOCK DATA SYSTEMS IN THE CENTRALLY PLANNED COUNTRIES

Fletcher Pope, Jr.*

A government statistical organization in each of the Centrally Planned Countries has responsibility for the collection and publication of economic data, including those on livestock. The names of these organizations are quite similar but they do vary somewhat from country to country. For example, the USSR has its Central Statistical Administration and the People's Republic of China (PRC) has its State Statistical Bureau.

The quantity and types of data on livestock published by the Centrally Planned Countries vary greatly however. These variations in published data between countries are largely attributable to three factors. First and foremost are the differences in governmental policies between countries concerning publication of data. For example, the PRC has an extremely restrictive policy with respect to the publication of statistics, including those on livestock. The second factor is the importance of livestock raising to the economy of the country, such as in the case of the USSR and Poland. And thirdly, the size of the country and the complexity of its administrative subdivisions are factors. For example, the USSR has fifteen union republics, about 125 oblasts, krais, and autonomous republics, and roughly 3,000 raions. (The oblasts and krais are roughly equivalent to our states and the raions to our counties.)

There are also several factors which tend to promote uniformity in the data of these countries. First, all of the countries have highly centralized governments which are tightly controlled by their respective Communist Parties. Secondly, all of the Centrally Planned Countries, except the PRC, Albania, and Yugoslavia (an associate member), are members of the Council for Mutual Economic Assistance (CEMA), which publishes a statistical handbook each year containing comparable data on the member countries.

The basic sources of economic data on livestock and other subjects in the Centrally Planned Countries are the statistical annuals or yearbooks published by the USSR and the countries of Eastern Europe. Unfortunately, the PRC does not publish any such data books. The USSR in recent years has been publishing an abbreviated statistical handbook, *SSSR v tsifrakh (The USSR in Figures)* in April, a foreign trade data book, *Vneshnyaya*

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torgovlya SSSR (Foreign Trade of the USSR) in June or July, and finally a more comprehensive statistical annual, *Narodnoye khozyaistvo SSSR (The National Economy of the USSR)* in November or December. Also, the union republics, including the Russian Federation (RSFSR), the Ukraine, and the Kazakhstan, publish statistical handbooks annually on their economies. Finally, specialized statistical handbooks are published periodically, including one on agriculture, *Selskoye khozyaistvo SSSR (Agriculture in the USSR)* each ten years.

The countries of Eastern Europe publish the following statistical handbooks annually:

Bulgaria—*Statisticheski Godishnik na N.R.B. (Statistical Annual of the People's Republic of Bulgaria)*
Czechosolvakia—*Statisticka Rocenka CSSR (Statistical Annual of the Czechoslovak Socialist Republic)*
East Germany—*Statistisches Jahrbuch der Deutschen Demokratischen Republik (Statistical Annual of the German Democratic Republic)*
Hungary—*Statistikai Evkonyv (Statistical Annual)*
Poland— *Rocznik Statystyczny (Statistical Annual)*
Romania—*Anuarul Statistic al Republicii Socialistite Romania (Annual Statistics of the Socialist Republic of Romania)*
Yugoslavia—*Statisticki Godisnjak, SFRJ (Statistical Annual of the Socialist Republic of Yugoslavia)*

In addition, some of the East European countries publish abbreviated statistical handbooks and foreign trade handbooks annually.

Each year CEMA publishes *Statisticheskiy ezhegodnik stran-chlenov soveta ekonomicheskoy vzaimopomoshchi (Statistical Annual of the Member Countries of the Council for Mutual Economic Assistance).*

The following portions of this paper contain a discussion of the data on various aspects of livestock raising contained in these statistical handbooks published by the Centrally Planned Countries.

LIVESTOCK NUMBERS DATA

The *USSR* regularly publishes on January 1 numbers of cattle, cows, swine, sheep, goats, horses, and poultry, and periodically publishes numbers for other types of livestock such as reindeer, camels, mules, and rabbits. The regularly published data on livestock numbers are broken down by category of ownership, i.e. state farms, state farms and other state agricultural enterprises, and collective farms and interfarm enterprises—all of which comprise the socialized sector—and privately-owned livestock, the private sector. Also, total numbers for cattle, cows, swine, sheep, goats, and poultry are broken down by republic in the USSR handbooks and by oblast, krai, and autonomous republic in such republic handbooks as those for the RSFSR, the Ukraine, and Kazakhstan.

In recent years, the USSR has been providing a breakdown by age and sex for certain types of livestock. These data are provided for the USSR as a whole for cattle, swine, sheep, and goats, and occasionally there is a breakdown by type of poultry under the U.S.-U.S.S.R. Agricultural Exchange Agreement signed in June 1973. Also, under the exchange agreement, the Soviets annually provide data on the number and liveweight of livestock slaughtered. These data cover cattle, swine, and sheep and goats for the USSR in total as well as for the socialized sector. These data, as well as other livestock data, are also published periodically in *Vestnik statistiki (The Herald of Statistics)*, a monthly journal.

Livestock numbers for the socialized sector for the USSR as a whole are published monthly throughout the year. The data are numbers as of the first of each month and cover cattle, cows, swine, sheep and goats combined, and poultry.

The *East European countries* also regularly publish numbers annually for the major types of livestock. These data cover cattle, cows, swine, sheep, goats, horses, and poultry. The data are not only in terms of numbers for the country as a whole but also for the socialized sector and for the private sector. In addition, several of the countries publish data on livestock numbers in different regions. For example, Czechoslovakia publishes data for the Czech Region and the Slovak Region while Yugoslavia provides data for seven different regions. Data on livestock numbers in Albania have not been published since 1965.

The *PRC* has not published any consistent, reliable data on livestock numbers either for the national or for the provincial levels since publication of the book *Ten Great Years* in 1959. This book provided economic statistics, including those on livestock raising, covering the period 1949-58. Since then, there has been almost a complete blackout with any references to livestock numbers generally restricted to sporadic percentage increases over a previous period for a given type of livestock in a specific administrative subdivision. As a general rule, the number of livestock for the previous period is not available. FAO (Food and Agriculture Organization), however, has been making and publishing estimates of PRC livestock numbers in its production yearbooks.

LIVESTOCK PRODUCTION DATA

The *USSR* regularly publishes in its statistical handbooks annual production of meat (carcass weight), milk, eggs, and wool with meat broken down into beef and veal, pork, mutton and goat meat, and poultry meat. The availability of published livestock product data for the socialized sector and the private sector as well as for the various administrative subdivisions in the USSR is much the same as that for livestock numbers discussed in the previous section of this paper. This also applies to data on measures of livestock productivity such as milk yield per cow and wool clip per sheep in addition to data on state procurements or purchases of

livestock and livestock products from the farms including livestock and poultry (liveweight), milk and milk products, eggs, and wool.

The USSR also publishes figures on industrial output of livestock products. This information, on a calendar year basis, includes meat (carcass weight) broken down by type, sausage, butter, cheese, and whole milk products (in terms of milk). Monthly data cumulative from the beginning of the calendar year are published on meat, butter, whole milk products, and powdered milk and cream.

The *East European countries* also regularly publish data on production and procurement of livestock products. The types of products covered are generally the same as those enumerated above for the USSR and the breakdowns by sector and by region within the countries are generally the same as those indicated in the above discussion of the livestock numbers published by these countries.

The *PRC*, as with livestock numbers, publishes little or no information on production of livestock products.

OTHER LIVESTOCK DATA

The USSR and the East European countries have fixed *procurement* (state purchase) *and retail prices* for livestock and livestock products which are only changed periodically by the State Pricing Committees. The procurement prices vary by item or product, by region where produced, and by quality. Retail prices are uniform throughout each country for a given product but do vary according to quality. Data on procurement and retail prices are not published regularly since they are changed at infrequent and irregular intervals. However, the total amounts paid by the USSR for the purchase or procurement of livestock and selected livestock products each year are published and average procurement prices can be calculated for several livestock products.

Calendar year *trade data* are published regularly by the USSR and the East European countries on livestock and livestock products. The data include the number and value of livestock for slaughter as well as for breeding and the quantity and value of the major livestock products. These data also include countries of origin and destination for the major trading partners.

The USSR and the East European countries, except Romania, publish *per capita consumption* data for selected livestock products, including meat (including fat), milk and milk products, and eggs.

The *PRC* publishes no data on prices, per capita consumption, or trade. However, incomplete data on the PRC's trade in livestock and livestock products can be compiled from the trade data of the PRC's trading partners.

None of the Centrally Planned Countries publishes any specific information on the occurrence or extent of *livestock diseases* in their countries, at least not in any publication available to the Economics, Statistics and Cooperatives Service (ESCS) of the U.S. Department of Agriculture.

With respect to a *livestock data base,* ESCS has compiled and published data for the period 1950 to the present on numbers of the principal types of livestock and on output of the major livestock products for the USSR and the East European countries. Such data prior to 1950 were not compiled and published because of the abnormal conditions existing in these countries as a result of collectivization of agriculture in the USSR in the 1930's, the destruction during World War II, and the establishment of new regimes in Eastern Europe following the war.

ECONOMIC DATA SYSTEMS IN EUROPE

Peter R. Ellis*

There are dozens of data bases relating in some way to the economics of livestock production in Europe. Numbers and values of animals bought and sold, characteristics and productivity of herds in geographical areas, and farm income data have been recorded in most European countries for many decades. The quality and frequency of each country's recording system has improved steadily so that commentaries on trends in the livestock industry can now be published regularly in specialist reports and the farming press. Motivation for such extensive data collection has come from a long tradition of controls on the production of meat, milk, wool, and animal by-products. Where controls have not been applied directly by governments, networks of cooperatives have grown up to direct or influence producers into orderly production and marketing. To operate efficiently both official and private control systems had to develop recording systems and from these have arisen a wide variety of actual and potential data bases relating to livestock.

The gathering of specific information on the data bases related to livestock productivity and economics has proved a very difficult task. A provisional list has been assembled for the purposes of this paper but it is far from complete (Appendix I). Documents to which specific reference is made are not numbered consecutively in the text but are incorporated under sections of the Appendix. Classification has presented a further problem and for the purposes of discussion they have been grouped into Factual Data Bases, Management Data Systems which are creating centralized or distributed data bases through recording and advisory services, and International Data Bases that draw from these various sources, selected reference material, and data so that they can be read or accessed through a computer network.

FACTUAL DATA BASES

Each country in Western Europe has developed a computerized farm census and market survey systems from which detailed statistics and, more frequently, summary reports are prepared. The publications are usually

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obtainable from ministries of agriculture or government publication centers but, as yet, neither the raw data nor results of analyses can be accessed through computer channels. A complete listing and description of what is, therefore, quite historic material would be tedious and pointless in the context of this symposium but a number of illustrations of coverage could be of interest.

In Great Britain the government's annual farm census gives a complete breakdown of farm structure county by county which includes sizes and types of holdings with livestock. Quarterly partial samples highlight changes that are taking place in the interim. A confidential farm income survey is conducted regularly by certain universities for the government, and the National Farmer's Union has its own parallel system, to collect data for negotiating commodity price support levels.

The Meat and Livestock Commission (MLC) publishes a monthly U.K. Market Survey of slaughter stock and meat, including quantities and prices for a detailed breakdown of products.

Quarterly reports deal with production and market trends in all the other European Economic Community member countries as well as the U.K. and summarize the situation in the wider international markets for livestock. The Milk Marketing Boards (MMB) of England, Wales, and Scotland control the entire country's dairy industry. They act as intermediaries between farmers and processors of virtually all the milk that is produced. The yield and certain other data on each cow are recorded and computerized each month together with results of milk quality tests. Since the Board's employees also undertake artificial insemination for more than half the cows in the country and operate extensive bull studs they are also able to monitor breeding standards for a large proportion of the national dairy herd. The result is a complex of very detailed published reports such as *Dairy Facts and Figures* and the *Report of the Breeding and Production Organization* but as yet none of the Board's data are accessible to other organizations through computer channels.

As indicated in Appendix I, similar published material is available for most European countries but it appears that, as in Britain, there is very little coordination, or even cooperation, between the organizations within each country that monitor different aspects of the livestock industry. Certainly it is rare for computerized material from one organization to be accessible to another.

MANAGEMENT DATA SYSTEMS

Within the last twenty years increasing intensity of livestock management has led farmers to undertake routine recording of inputs, outputs, and significant events in their herds. Individual cow and sow history records are now commonplace, as are periodic records of average feed usage, production, sales, and losses from the livestock unit. The introduction of

electronic data processing has transformed the time consuming, and often neglected, analysis of these records into a series of detailed management aids. In Britain some are based on milk recording, e.g. MMB Herd Management Control; others on feeding, e.g. MLC Feedplan; and others on accountancy, e.g. Agricultural Costings Limited. In France the I.G.E.A. provides a farm business management scheme. Several other countries, including Denmark, Norway, and Sweden, have gone as far as developing a centralized lifetime computer record for each dairy cow which can be used as a basis for genetic selection and a variety of research purposes as well as management policy determination.

The data on performance patterns are used by farmers and their advisers, consultants, and salesmen as a basis for policy decisions in individual livestock enterprise. The main growth of such systems has been associated with the development of computer services and the principle has been to send in recorded data periodically so that the producer could be given an analysis of his results. These could be compared with the objectives that he had set himself in terms of growth and productivity or with a set of averages generated from the pooled data from a large number of sources. *Dairy Facts and Figures* (MMB), *Pig Facts* (MLC), and *Sheep Facts* (MLC) provide averages, ranges of management efficiency, and ranges of financial return to different types of production systems in the United Kingdom. The production of these and similar publications in other countries implies that important data bases are being created at the micro-economic level.

Management consultants and extension services are stimulating further developments along these lines by applying predictive programs to the data received. Reading University's Melbread, Dandair, and Youngstock schemes take a diary record of events that have occurred in the dairy herd each month and provide lists of actions required and events expected, as well as updated summaries of performance.

In the last year a fundamental change has been introduced to this type of service by the arrival of microcomputers on the European market at prices which the more affluent individual farmers can afford. Herd and flock data management systems are being reexamined and continuous monitoring of productivity and management will probably become a routine in a rapidly increasing proportion of livestock units over the next decade. Reading University's "Daisy" system is an example of how the large volume of data that are generated on breeding, feeding, and health in the modern dairy herd can be stored in a microcomputer on the farm and, automatically, put to use as a management aid. Other systems for dairy, pig herds, and sheep flocks with a similar aim are also under development in several European countries.

In reality, these computerized systems constitute dynamic distributed data bases. Not only do they provide analyzed material for other data bases but also they allow the cumulative storage of raw data on discs or tapes, as well as immediate printouts, whenever they are required. Harmonization of core data in such systems is exposing great new potentials for longitudinal appraisals and research into the influence of individual factors

on productivity.

INTERNATIONAL DATA BASES

The term "harmonization" identifies the key to success in developing data bases for international use. To be of value for policy and research purposes the data must be truly comparable from country to country. The European Economic Community is taking the initiative for its nine member countries in these respects. Of direct application to the interests of livestock economics are the EUROSTAT publications derived from the CRONOS agricultural data bases, which include physical and financial statistics on all aspects of livestock industry at the national level, and RICA, which accumulates farm accounting data that serve as a basis for the annual price reviews and for the determination of intervention prices for agricultural commodities supported by the Community. A new data base is under development to provide information on the management systems for the projects that are financed by FEOGA, the European Agricultural Development Fund.

The development of EURONET by the EEC is aimed at the sharing of a series of selected data bases which also involves the rationalization of the national source material. Inputs will be in a common form from all countries, and a single access point, a major computer, will provide national links to the EURONET data bases. It must be borne in mind that a primary objective is to attain free trade between all member states. The Community is also building a collection of data bases covering all collective community activities. Among the data bases being developed to this end by the Community are ECDOC, concerning documentation under discussion by the Council of Ministers, CELEX, comprising policy documentation published in the official journal, and, to come shortly, USACAD, covering material on the applications of established directives.

The services to be offered by EURONET in connection with these data bases are selected dissemination of information as part of a continuous effort to match interests and profiles with the current files, retrospective searching, and republication of results of searches that have been carried out. Outputs are in the form of printout, video, and machine readable tapes.

Coverage of the general agricultural and livestock literature is to be undertaken in connection with AGRIS (FAO) with EURONET headquarters acting as the European regional section. Yet another data base of particular interest will be one on "Agricultural Policy" which concerns forecasting and could be used as a basis for evaluating changes in the livestock field that would have animal health implications.

Information on all the relevant EEC publications and systems can be obtained from the Commission in Brussels. Collated summary information on the countries not covered by the EEC is contained in the publications

of FAO, including the *Commodity Reports, Animal Production Yearbook,* and the *Trade Yearbook.* Periodic analyses are also made for some countries by the Organization for Economic Cooperation and Development (OECD).

SPECIFIC VETERINARY ECONOMIC DATA BASES

Health is a constant preoccupation of the consciencious livestock manager. If we wish to define which data bases are of importance for health economics we should first define what the data needs really are. Economic considerations must enter into the selection of effective treatment, the promotion of herd health and welfare by such tasks as fertility control (often termed veterinary preventive medicine), and the formulation and implementation of official animal health policies.

The first two of these considerations involve the costs of veterinary products and services, other input costs, and the output values from the animals concerned. Eventual decisions are based on the application of these financial values to the treatments and management changes that seem operationally feasible in each herd situation.

Official policies and programs are required primarily for disease problems and risks that cannot be overcome by the initiative of individual herd owners. In addition to assessing the additional operational, input, and output costs for the possible policies that might be adopted, general economic policy has also to be taken into account. In particular, supply and demand effects of the animal products lost or gained and the true economic value of the different factors involved, must all be integrated into the economic analyses for the policy maker to work with. Issues of risk and uncertainty and possible health implications for man may also arise which can require the use of broader collections of data and economic values.

All such veterinary activities in livestock enterprises are aimed at restoring animals to normalcy and maintaining their health while productivity is improved. To be completely effective these activities must be based on knowledge of how the normal production system operates and of the contributions that animal genetics, housing, mechanization, management, nutrition, climate, and other environmental factors make to the development of ill-health. The incorrect orientation of a calf-house for prevailing winter winds, for example, may activate latent respiratory infection and could, therefore, be termed the main causal factor of respiratory disease. Similarly, the stocking pattern of sheep on pasture can be regarded as the main determinant of gastro-intestinal parasitism. Thus, the economics of veterinary activity must always be related to the economics of the whole production system and, for large scale programs, to the macro-economy of the industry and the country.

These arguments lead to the conclusion that most of the information likely to be needed in Europe for veterinary economic purposes is already being

collected by the various means that have already been discussed. Adjustments to meet these specific needs could be made in the normal processes of revision. Gaps exist, however, in the areas of cost effectiveness of veterinary measures and the impact of ill health on productivity.

The first of these gaps will have to be filled by new practice data management systems. In Denmark steps are being taken in this direction by a cooperative maintained by more than half of the private veterinarians in the country. This provides a computerized billing service for farmer clients and plans are being made for appropriate adjustments and analyses for this large data base. A similar potential exists in the semiautonomous animal health services of Sweden and Norway, which operate general herd health programs. The computerization of major disease control programs, such as that for brucellosis in Great Britain, has created the capability of accurate costing of individual activities and various types of predictive assessment for expenditures and returns. Other countries including France, Germany, and Italy are conducting pilot studies on decentralized data processing, using networks of mini-computers for these purposes.

Progress also seems imminent in the more accurate assessment of the impact of disease. The new herd management records systems are making it possible to relate disease events to changes in productivity of individual animals and to farm income. In some instances effects in individual animals over long periods of time are becoming evident and measurable. Meanwhile changes in procedure for recording major disease incidents and regular status reports on actions taken are providing more accurate information on the extent of economic effects.

In the EEC steps are now being taken to form appropriate veterinary data bases for Community use and to link them with broader international data bases. At present the main emphasis is on specific factual and bibliographic data. Economic data bases on herd health will undoubtedly evolve in due course. Plans are also in hand for the harmonization of the national veterinary program information networks that are now at the pilot stage of development in several countries.

CONCLUSIONS

The need for rationalization and integration of livestock data bases in Europe is clearly recognized. However, given the constitutional structure of most member countries and the individualism of livestock owners, it seems probable to the author that "tiered" information systems providing distributed data bases are likely to be preferred to centralized data bases for economic data management. Machines can now be taken to data and time-critical analyses can be undertaken on or near the farm—at the point of implementation—which should both improve the quality of data and simplify storage.

The potential of this prospect is enormous but also alarming. Unless agreements are reached on nomenclature, program specifications, and compatible software systems, there is a danger of a multiplicity of sophisticated data management schemes which cannot contribute to common data bases. If such agreements can be reached, however, the possibilities of voluntary search of the large decentralized pools of data offer completely new dimensions in operational research.

In veterinary economics certain specific data bases are needed on costs and disease impact but the main trend will almost certainly be to develop interfaces with a wide variety of technical and economic data bases rather than to aggregate a large amount of relevant material. An increasing battery of computer models is providing a basis for herd health and industry health policy decisions and appropriate interfaces could provide automatic access to the data required for these models.

The overriding conclusion from this review is, therefore, that the concept of data bases is changing and that Europe urgently needs to take a coordinated look at the data-processing developments that can be expected over the next few years. Rationalization and harmonization must begin at the different primary sources within countries as well as at national and international levels if major new benefits are to be obtained from the changes that are taking place in information systems.

APPENDIX I. AGRICULTURAL STATISTICS SOURCES

A. EUROPEAN ECONOMIC COMMUNITY (EEC)

Abbreviations: CEC—Commission of European Communities
MLC—Meat and Livestock Commission, U.K.
A—Annual
Q—Quarterly
B—Bimonthly
M—Monthly
W—Weekly

1.	*The Agricultural Situation in the Community*, CEC	(A)
2.	*Farm Accountancy Data Network for the EEC*, CEC	(A)
3.	*Dairy Facts and Figures*, EEC, Milk Marketing Board, U.K.	(A)
4.	*International Market Survey*, MLC, U.K.	(Q)
5.	*European Market Survey*, MLC, U.K.	(M, W)
6.	*EEC Meat and Livestock Statistics and World Livestock Numbers*, MLC, U.K.	(A)
7.	*EEC and World Prices of Meat and Livestock*, MLC, U.K.	(A)
8.	*Agra—Europe*	(W)

EUROSTAT Publications:

9.	*Yearbook of Agricultural Statistics*	(A)
10.	*Purchase Prices of Means of Production*	(B)
11.	*Selling Prices of Animal Products*	(B)
12.	*Index of Production Prices of Agricultural Products*	(B)
13.	*Monthly Statistics of Meat*	(M)
14.	*Monthly Statistics of Milk*	(M)
15.	*Agricultural Markets—Livestock*	(M)

Prepared by Directorate of Scientific and Technical Information and Information Management, CEC, Brussels.

16. EURONET—Computer data base eventually to cover wide range of subjects. Agricultural section CRONOS is used to compile EUROSTAT publications. RICA will cover form accounts data.
17. Information on Agriculture, CEC series on invoices, topics e.g. Veterinary Vaccines No. 17.
18. European Association of Information Centres, Brussels. Mainly concerned with research abstracts. (London Office: 3 Belgrave Square)

B. INDIVIDUAL COUNTRIES

BELGIUM

19. Minstere de l'Agriculture. *Agricultural Statistics*.
20. Institut Economique Agricole. *Accounting and Financial Analysis*.

DENMARK

21. *Landøkonomisk Oversigt.* Annual agricultural statistics by Federation of Danish Farmers Unions.
22. Danish Agricultural Advisory Centre, Landbrugets, E.D.B. Centre (LEC) Milk, cattle, pig recording.
23. Det Statistiske Department. *Landbrugsstatistik.* Livestock numbers.
24. *Landbrugsraadets Meddelelser.* Exports.
25. *Eksport Svineslagteriernes Salgsforening Statistik.* Meat industry annual statistics.
26. *Oversigt Over Kødkontrollen—Veterinaedirekoratet.* Slaughtering, disease incidence.
27. O.D.D. Accounting Association of Danish Vets.
28. Institute of Farm Management and Agricultural Economics. Annual survey of financial results.

FRANCE

29. *Annuaire Statistique de la France.*
30. *Bulletin Trimestriel.*
31. Institut National de la Statistique et des Études Economique. Production statistics.
32. Service Central des Enquetes et Études Statistiques de Ministère de l'Agriculture. *Statistique Agricole Annuelle.*
33. Federation Nationale des Organismes de Controle Laitier. Milk recording societies.
34. Data Bank of National Institute for Rural Management and Economics.

GREECE

35. National Statistical Service.
36. *Agricultural Statistics of Greece.*

IRELAND

37. *Irish Statistical Bulletin,* Central Statistics Office.
38. *Irish Farm Bulletin,* Department of Agriculture.
39. *Farm Management Survey.*

ITALY

40. Ministero dell'Agricoltura, Rome.
41. *Annuario de Statistics Staliono,* Instituto Centrole di Statistica.
42. *Annuario di Statistische Provenciali,* Instituto Centrole di Statistica.
43. IDAIC (Istituto di Diritto Agrario Internazionole e Comparots), Firenze, Italy. Development of state data base for legislation structure, trade, finance, etc., in agriculture.

LUXEMBOURG

44. Ministry of Agriculture.
45. Federation des Herdbooks, Luxembourgeois.

NETHERLANDS

46. *Statistical Yearbook of the Netherlands.*
47. Central Bureau voor de Statistick. Livestock numbers, etc.
48. Landbouw-Economisch Instituut. Survey of farm accounts and feed prices.
49. Stichting Gemeenschappelijke Informatic. *Verwerking voor de Rundueehouderij.* (GIR) (Foundation Common Data Processing Centre for Cattle Husbandry). Includes milk recording. (Centrale Melkcontrole Dienst), A.I.
50. *Statistisch Weekrapport.* Slaughterings, meat.
51. *Produktschap voor Vee en Vlees.* Cattle prices.
52. IMAG data service, Institute of Agricultural Engineering, Wageningen. Labor and resource planning, prices.

NORWAY

53. *Statistisk Sentralbyraa Jordbruksstatistikk.* Agricultural statistics.
54. National Board of Animal Production Recording, Oslo.

SPAIN

55. Ministerio de Agricultura. *Anuario de Estadistica Agroria.*
56. Comite Naçional Español de Zootecnia. Livestock and dairy production records.
57. Asociasion General de Ganaderos del Reino. Livestock and dairy production records.

SWEDEN

58. Statistiska Centralbryaan. *Jorndruksstatistisk Aarsbok—Statistiska Meddelanden.* Agricultural statistics.
59. Landbruksdata—A.I., milk recording, pig recording, beef recording—computer, offered by Svensk Husdjursskotsel (Association—Swedish Livestock Breeding and Production).
60. Mejeristatistik Svenskee Mejeriernos Riksjorening. Milk products.
61. National Board of Agriculture, Jowkoping. Milk recording.

WEST GERMANY

62. *Statistisches Jahrbuch—Stats Yearbook—Tierseuchen—Bericht.* Disease outbreaks. Twice monthly.
63. *Statistischen Monatsbericht.*
64. *Agrarwirtschaft.* Prices.
65. Bundesministerium für Errahrung, Landswirtschaft und Forsten (BELF). Slaughterings, meat.
66. Z.M.P. die Agramarhte. Sheep, pig, beef and feed prices.
67. Nationales Komitee für Milchleistungsprufungen. Farm Accounts System, Baden-Wurtemberg.
68. BALIS—Bavaria. Collection of computerized data bases, e.g. farm business, planning, finance, and marketing.

C. UNITED KINGDOM

69. *Agricultural Statistics.* Her Majesty's Stationery Office.
70. *Agricultural Price Indices.* H.M.S.O.
71. *Monthly Digest of Statistics.* H.M.S.O.
72. *Annual Abstract of Statistics.* H.M.S.O.
73. *Output and Utilisation of Farm Produce in the U.K.* Ministry of Agriculture, Fisheries and Food.
74. *Overseas Trade Accounts.* H.M.S.O.
75. *Dairy Facts and Figures.* Milk Marketing Board.
76. *Meat and Livestock Statistics.* MLC
77. *Market Survey.* MLC

Recording Schemes:

78. Milk Marketing Board: National Milk Records.
79. Low Cost Production Unit: Milk Marketing Board.
    a. Total Farm Business
    b. Farmstate
    c. Dairy Management Scheme
    d. Herd Management Control.

Meat and Livestock Commission:

80. Feedplan
81. Pigplan
82. Performance recording, beef, sheep, and pigs
83. Dairy Enterprise Plan—BOCM-Silcock
84. Pig Forecasting and Monitoring—BOCM-Silcock
85. Dairymaid—I.C.I. Ltd.
86. Cash Plan—I.C.I. Ltd.
87. Mascot—I.C.I. Ltd.
88. Melbread—Reading University. Herd health and fertility systems.
89. Daisy—Reading University. Dairy information systems.
90. Farm Management Survey. M.A.F.F.
91. VIDA (Veterinary Investigation Diagnosis Analysis). M.A.F.F.
92. National Farmers Union.
93. *Farmers Weekly.* Prices.

GENERAL SOURCES

Food and Agriculture Organization (FAO)
Animal Health Yearbook
Production Yearbook
Trade Yearbook
The State of Food and Agriculture Commodity Review and Outlook

Organization for Economic Cooperation and Development (OECD)
2 rue Andre-Pascal 75775 Paris Cedex 16, France

ECONOMIC DATA SYSTEMS FOR LIVESTOCK PRODUCTION IN DEVELOPING COUNTRIES

Howard L. Hall*

Livestock are of growing importance in the developing countries, and in recent times, a general improvement of data on production has been associated with favorable trends in economic development, with rising demand for products, and with assistance provided by international and other organizations. However, the availability of data varies widely and complete systems are still an exception. Information on numbers, slaughter, production, trade, and prices tends to be fragmentary, varied in sources, and limited for potential use in most countries.

Variation in availability of data among countries is usually related to limitations imposed by economic factors. The principal objectives of this paper are to develop a general background and analysis of those factors affecting the availability of data, to provide information on existing data systems, and to evaluate data sources for their use in the developing countries and in other information systems.

BACKGROUND

According to current definitions, and excluding the developed and centrally planned economies, developing countries number 110 in a world total of 145. Located mainly in the earth's torrid or tropical zone, they include all of the African Continent and the Middle East, much of Asia, and most of Latin America. Estimates by the Food and Agriculture Organization of the United Nations (FAO) indicate that the 110 countries account for approximately forty-eight percent of the world's fifty million square mile land area, about forty-nine percent of its four billion people, and sixty-one percent of the rural population. (See Table 1.)

The developing countries include the smallest and some that rank among the world's largest in areas and populations. Areas range from less than 1,000 to over three million square miles, and numbers of people from about 100,000 to over 600 million. Population densities of less than twenty persons per square mile in some African and South American countries

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contrast with 500 or more in parts of Asia, the Caribbean, and Central America.

Low incomes and limited growth are characteristics of the rural economies predominant in the thinly populated areas of southern Africa and some densely populated countries in Asia where national income averages are still below $100 per person.[1] Income levels rise to ranges of $500 to $1,000 per person in the more urbanized, trade and industrially oriented countries of Latin America and Asia. They approach and, in a few instances, exceed those of the developed nations in the fast growing petroleum countries of the Middle East.

TABLE 1. Developing Countries: Area, Population, Livestock and Poultry Numbers, and Per Capita Production of Meat and Milk, by Regions, 1976

Region	Africa	Asia	Latin America	Developing	World
Area (1,000 sq. mi.)	11,025	5,722	7,720	24,467	50,495
Population					
Total (millions)	407	1,261	314	1,982	4,026
Urban (percent)	34	37	62	40	52
Density (per sq. mi.)	37	220	41	81	80
Numbers (million)					
Cattle, buffalo	158	373	258	789	1,338
Sheep, goats	279	349	139	767	1,437
Swine	8	32	68	109	638
Poultry	507	997	734	2,239	6,401
Per capita production (kilograms)					
Beef, buffalo	6	2	31	6	12
Mutton, goat	3	1	2	2	2
Pork	1	1	7	2	10
Poultry	2	1	6	2	6
Milk	27	38	107	45	109

Source: United Nations, Food and Agriculture Organization, *Production Yearbook*, vol. 31 (Rome, 1977).

The economic importance of agriculture is indicated to some extent by rural population percentages which vary from fifteen to ninety percent among the developing countries. Aside from the mineral and petroleum producers, economic growth is affected, to varying degrees, by rugged topography and the extremes in climate which restrict land available for agricultural development. The limited agriculture of the predominantly rural countries, particularly in the arid and wet tropical areas of Africa and Asia, is devoted mainly to domestic food crops and livestock. Export crops including coffee, cocoa, cotton, fruits, rice, and oilseeds compete strongly for the better agricultural lands and have provided the basis for trade and economic development in the limited sub-tropical and temperate areas of Southeast Asia, Latin America, and West Africa.

Current estimates indicate that livestock products exceeded twenty-five percent of total agricultural production in only nineteen of fifty-five developing countries for which data were available.[2] Sheep and goats are important in the small scale and often migratory agriculture of North Africa and the Middle East. Cattle, buffalo, and swine predominate in the more intensive small farm production in Southern Asia. Cattle are considered important sources of wealth and trade in many rural areas of Southern Africa. Extensive grazing enterprises support a well developed meat trade, particularly in the Central and South American countries. Supplemental feeding of livestock is very limited and expansion in most countries is restricted by poor grazing conditions and serious disease and insect problems. Recent estimates by the FAO indicate that per capita meat production, including poultry, averages five kilograms in the Asian countries and twelve kilograms in Africa compared with forty-six in Latin America and a world average of thirty kilograms.

Latin America is a major world source of meat and cattle exports, and the developing countries are important in the wool trade. Significant numbers of cattle, often unregistered, move between countries in both Africa and South America. In general, the developing countries of the Middle East and Latin America also provide a growing market for breeding animals, meat and dairy products.

GENERAL AVAILABILITY OF DATA

In recent times, some increase in availability of data on livestock production has been associated with a general improvement in economic information systems for agriculture in the developing countries. Major factors appear to be strong pressures for economic growth to meet demands of larger urban populations, and the related requirements for financial and technical assistance in resource and other development.

The International Monetary Fund currently receives economic data including financial, foreign trade and payments, national accounts, and general price trends from about seventy-five of the 110 developing countries. The FAO and other international agencies have encouraged countries to increase

their activities relative to collection of population, agricultural, and other census data during the past two decades to better complement the regular reporting of economic data used in their world wide information systems. Agricultural and other economic sector studies have been increased to support loans and technical assistance from the world and regional development banks and other assistance agencies.

Economic data for agriculture, included in these country information systems, are generally oriented to crops and livestock products important in domestic and foreign trade. Agricultural information is very limited because of lack of financial resources in many rural, small farm economies, particularly in Africa. Economic data also tend to be limited in smaller countries of Asia, the Caribbean, and South America where commercial food and export crops are predominant, and livestock production is mainly for local use. Information is also affected by serious difficulties of data collection because of the extensive nature of livestock enterprises in other countries.

Economic data available on livestock production in the less developed countries vary widely by type and sources. Information on livestock numbers is generally limited to estimates from periodic census of agriculture or occasional surveys, often conducted by national statistical agencies. Those agencies also collect data for use in consumer and other price indices, and industrial statistics used for tax and other purposes may provide estimates of commercial slaughter and meat production in licensed establishments. Detailed trade information in annual reports is generally limited to livestock and livestock products important in total exports.

ECONOMIC DATA SYSTEMS

Major improvements in data sources have occurred in the more developed countries with significant exports or with strong domestic and import demand. A limited survey indicates that published data provide continuing estimates of livestock numbers, commercial slaughter, trade, and production of livestock products in twenty-one of the developing countries. (See Appendix I.) Product prices are usually published and statistics related to animal health are sometimes included.

Although data sources in these countries are more comprehensive, systems often are similar in general organization and subject to some of the limitations found in less developed areas. For the most part, current livestock numbers are based upon agricultural censuses which may be at more frequent intervals. Data on animal slaughter and meat production are still from licensed commercial establishments which often account for a large proportion of the total. Major differences often take the form of more detailed and extensive information on trade and prices.

Important exceptions include Argentina, Kenya, and South Africa, where

census data are supplemented by periodic livestock surveys, and meat and other product boards have well developed data on the commercial livestock industries (meat, wool, milk). Brazil's Ministry of Agriculture maintains an extensive system of reporting through cooperation with state and local governments; and information from cattlemen's associations and other rural organizations is important in Mexico and some Central American countries.

A trend toward improved data systems appears to be related to rising commercial demand for livestock and other agricultural products in other developing countries. Livestock and livestock products are included in sample agricultural surveys reported to be operating for Israel, Panama, Paraguay, South Korea, Taiwan, and Venezuela. Current information suggests that similar systems may be in progress in Chile and some other countries.

GENERAL USE OF DATA

The potential use of economic data on livestock production within countries or in the FAO and other information systems is still limited. Census estimates, which provide principal sources of data on change in numbers, are often not available or are taken at infrequent intervals. Evaluation of changes in production is also affected by the lack of comparability in census numbers and the commercial slaughter and trade in livestock. The analysis of changes in commercial production and consumption of livestock products is restricted by the availability of information on trade in many importing countries.

The FAO maintains the most comprehensive information system on the agricultural production and trade of the developing countries. However, a review of FAO data for 1975 indicates that estimates on numbers of cattle, sheep, and goats were received from only thirty-seven countries and from twenty-seven countries for swine. Country estimates received for meat and milk production were even more limited, reflecting the difficulties of estimating the extent of unrecorded production for home and local consumption. Similar limitations were found in world estimates of livestock numbers and meat production prepared by the U.S. Department of Agriculture, which include data from only twenty-three developing countries.[3] Because of limited availability of data, livestock products are omitted from seventeen of the seventy-three developing countries included in the indices of agricultural production for Africa, Asia, and the Western Hemisphere.[4]

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3. U.S. Department of Agriculture, Foreign Agricultural Service, *Livestock Statistics in Selected Countries* (Washington, D.C., September 1975).

4. U.S. Department of Agriculture, Economics, Statistics and Cooperatives Service, *Indices . . . Asia and Oceania; Indices . . . Western Hemisphere; Indices . . . Africa and the Near East.*

APPENDIX I. SOURCES OF ECONOMIC DATA FOR LIVESTOCK PRODUCTION IN DEVELOPING COUNTRIES

I. Africa

Egypt	Central Agency for Public Mobilization and Statistics, *Statistical Yearbook*, Cairo
Kenya	Ministry of Finance and Planning Central Bureau of Statistics, *Statistical Abstracts*, Nairobi
Republic of South Africa	Ministry of Agriculture, Division of Marketing Research, *Abstract of Agricultural Statistics*, Pretoria
Sudan	Ministry of Agriculture, Department of Agriculture Economics, *Yearbook of Agriculture Statistics*, Khartoum

II. Asia

Israel	Central Bureau of Statistics, *Statistical Abstracts*, Jerusalem
Indonesia	Central Bureau of Statistics, *Statistical Yearbook*, Jakarta
Philippines	National Economic and Development Authority, *Statistical Yearbook*, Manila
Republic of China (Taiwan)	Department of Agriculture and Forestry, *Agricultural Yearbook*, Taipei
Republic of Korea	Economic Planning Board, Bureau of Statistics, *Statistical Yearbook*, Seoul
Syria	Central Bureau of Statistics, *Statistical Abstracts*, Damascus
Thailand	Ministry of Agriculture and Cooperatives, Division of Agricultural Marketing, *Agricultural Statistics of Thailand*, Bangkok
Turkey	Institute of Statistics, *Statistical Yearbook*, Ankara

III. Latin America

Argentina	Ministry of Economy, National Meat Board, *Statistical Reports*, Buenos Aires
Brazil	Secretary of Planning, Institute of Geography and Statistics (IBGE), *Annual Statistics of Brazil*, Rio de Janeiro

Chile	Ministry of Agriculture, Office of Agriculture Planning, *Agriculture Statistics, 1965-74*, Santiago
Colombia	National Department of Statistics, annual and monthly *Statistical Reviews*, Bogota
Costa Rica	Ministry of Economy, Director of Statistics and Census, *Annual Statistics*, San Jose
Mexico	Secretary of Programming and Budget, *Annual Statistics of Mexico*, Mexico City
Nicaragua	Central Bank of Nicaragua, *Annual Economic Review*, Managua
Paraguay	Ministry of Agriculture and Livestock, Directors of Agricultural Statistics and Census, *Annual Survey of Agriculture*, Asunçion
Panama	Controller General of Panama, Director of Statistics and Census, *Annual Review*, Panama City

CONCLUDING REMARKS

Francis J. Mulhern*

It is a pleasure for me to conclude this international meeting of specialists in animal health and disease data bank activities with some summarizing remarks. We have been looking for ways to get the word to the users—to let them know just what information is available.

When I was first contacted about cosponsoring this symposium, I answered with an emphatic yes. The Animal and Plant Health Inspection Service needs this information. Our capabilities to meet the challenges of today and tomorrow are related almost directly to our ability to know what information is available and how we can use it in the area of animal health. The Animal and Plant Health Inspection Service also is responsible for plant protection, and we have an equally important need for information on plant pests and diseases.

As users, I don't know of any agency that has a greater need for this kind of information than ours. We need technical, economic, and sociological data. We need to know, for example, how much is known about a particular disease in the United States and throughout the world, what research is being conducted and how effective that research really is.

Information Needed for Cost Justification. We need to relate costs to benefits in controlling or eliminating a disease. In this day of limited resources throughout the world, our ability to sell control or eradication programs is dependent on cost-benefit procedures. In the early days, I recall saying that such-and-such a disease cost so much money. Then, I heard that same figure quoted for ten or fifteen years. We tried to find out where it originated, but no one knew. They just kept parroting what someone else had said about how much it is worth, or how much it cost.

We must be more sophisticated in our present operation. There must be a very close scrutiny of the statements from a cost-benefit standpoint because we are competing with other USDA agencies for limited funds. The strongest support I can have for APHIS programs is sound basic information on cost-benefits. We also need to know the quality of cost-benefit evaluations and to determine how comprehensive they were.

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Information Needed to Assess the Impact on Society. Sociologically we need to know how a disease is going to affect society. How is the program approach going to affect society? How is society going to react? You may have a very sound basis for eliminating a disease, but if it is not acceptable to the public, you might as well throw it out the window and start again. We are anxious to determine how other countries are reacting, particularly to those diseases that don't exist here.

Data Must be Manageable and Accessible. As I recall my career, I remember current disease history files that developed and grew until they occupied buildings. Important reports needed immediately could not always be located. We often felt that we were drowning in paper, but that we couldn't get the necessary information from it. Fortunately, our advancements in technology provide solutions to such problems. Our data processing computer capabilities fill a vital need.

Data Must Be Accessible. Now we are struggling to determine how to use information in the most effective manner. I recall being in Canada in the 1950's as a U.S. adviser during the foot-and-mouth disease (FMD) outbreak there. This outbreak occurred in the dead of winter. It was 58° below zero.

At that time, they were trying to dispose of infected and exposed animals. After we had all these animals slaughtered, we had to wait for a thaw to bury them. We faced all kinds of technical questions, such as how long this virus lives in meat, bones, feces, milk, straw, and blood. In trying to provide immediate answers, I found myself leafing through all of the literature to figure out who had the information. In many cases, there were no answers. There were guestimates about how long the FMD virus may live in particular animal byproducts. Also, there were data that reported the virus may live in a bone for specific numbers of days. They didn't test for longer periods, so the only thing they could say was that it lived for that limited time. When you are trying to handle an emergency situation, you want to respond more quickly and accurately than that. For each week during this time, a million dollars worth of trade was prohibited from moving between Canada and the United States. Every week that we postponed saying, "Canada is free," cost the Canadians a million dollars. That certainly underscores the importance of having data that you can rely on.

Vesicular Exanthema (VE). Vesicular exanthema is a swine disease caused by a virus that was first reported in California in 1932. It was confined to California until 1952, when suddenly it spread throughout the United States. We eradicated this disease in four years. Now we have all the data available showing what happened to the disease from the time we found it to the time we got rid of it.

In 1952, I spent a lot of time in library stacks, reviewing the literature since 1932. I was mainly interested in assumptions that were developed

and eventually used as facts. We finally clarified which were facts and which were assumptions. To say the least, it was an interesting experience, trying to derive facts from data based on assumptions, in order to give decision makers valid information to use in making judgments.

Venezuelan Equine Encephalomyelitis (VEE). In Venezuelan equine encephalomyelitis, we are concerned about viral reservoirs. When VEE struck Texas in 1972, we had to find out which insects, animals, and wildlife harbored the virus. Also, we tried to set up a monitoring system for the whole ecosystem, so that we wouldn't be surprised by a new outbreak.

Newcastle Disease. In 1972, the California poultry industry experienced an outbreak of Newcastle disease. We initiated an eradication program.

They said it couldn't be done! People who had been living there for years said that this disease was spread by the wind since the disease clearly was spreading in the direction of the prevailing wind. Also, these people said, migratory birds carried this disease on a path of northern-southern flights; therefore, even after eradication, it would only be back again within a year or so. Our epidemiologic studies, however, showed that wind was not the method of transmission. We found that mechanical spread of Newcastle disease, by movements of people and equipment, was more logically the cause. And after examining over 5,000 migratory birds, we found that they were not a factor in the spread of this disease.

Data Utilization Requires Understanding How the Data Apply. All I am saying here is that when you have good data and poor data, as well as assumptions and facts, you must keep searching for the truth. It is important that others appreciate our reasons for assembling and using this data.

I remember asking the Bureau of the Budget for millions of dollars to fight Newcastle disease virus. Their response: "How much is it going to take?" and "How quickly are you going to do it?" They found these kinds of silly questions very appropriate. We finally spent $56 million, but we had no idea at the outset of when we would reach the zero point. The major questions concerned economic significance. What we had going for us was that no protective vaccine existed to protect our broiler industry. The value of the broiler industry and the threat of Newcastle disease sold OMB on providing eradication money.

The point is that economic justification for eradication makes much greater sense to the user if you are trying to combat these kinds of diseases.

Assumption vs. Facts. When we began eradicating hog cholera (HC), we were told it was everywhere. It had been in this country since 1830, and had established itself thoroughly. There was no way to get it out completely.

A friend of mine, Dick Shope, an M.D., was doing outstanding work at that time on swine influenza. He showed me a big can of earthworms, intending to prove that these worms were a reservoir for HC virus. If true, we might as well forget about HC eradication. He demonstrated later that the virus could pass through the earthworms. However, after we completed the eradication program in all the states, there was absolutely no evidence that earthworms had been a cause of an outbreak or responsible for the perpetuation of hog cholera on a premises. Fortunately, when we started the eradication effort, we didn't know that the tabanid fly could spread HC virus. Later we discovered that it did, but only in one part of the country where tabanids are generally distributed. If those who objected to the program when we were trying to get it approved had known that tabanids could spread the disease, we might never have gotten funds for the program.

That was only one little facet of the information we needed. It taught us not to jump to conclusions based on assumptions. If you have information derived from experience in one or more geographical locations, don't assume that it applies throughout the entire country.

Information Needed on Benefits of Disease Eradication Programs. Economics sold the Congress on providing money for the hog cholera eradication program that was successfully completed in 1976. Benefits derived by the United States in just the past three years of freedom from this disease equalled the cost of the entire eradication program. An estimated $50 million annually was saved by eradicating hog cholera, and each year similar benefits continue to accrue.

Now let's consider a current disease problem. Just two years ago the state of Texas told us that they were no longer going to cooperate with our brucellosis program. We said, "That's great, but we hope you can live with your cattle. We are going to quarantine all of them." They said we were bluffing. Secretary Butz was here and he replied, "Just call us." Unfortunately, confrontation doesn't help anyone.

The cattlemen protested to Congress, challenging a program that they said was not technically or economically feasible. The cost benefits determined when brucellosis control began over forty years ago, they argued, no longer applied. They further argued that the information we had was no longer applicable, and that we should resume research that we had discontinued.

We accepted that argument. Yet assuring that these programs will be successful means solving technical and psychological problems. The psychological needs involve getting support, involvement, and commitment from the industry to do what is necessary. We approached an outside group and asked them to study the brucellosis program: to examine the technical and economic feasibility of eradication, and to evaluate the research and determine whether we should be doing more of it. That study took two years and it cost the Animal and Plant Health Inspection Service $250,000. Now wouldn't it have been great if all I had to do was telephone the

animal disease data bank and ask "Is it technically feasible?" or "Is it economically feasible?"

Well, that kind of information is accessible to everybody now. The study report is ready and can be made available to any other country in the world. It seems that we had to mark time for two years while the study was in progress. This is one example of how the economic and sociological evaluations that you have been discussing are needed in today's operation. We are going to need them even more in order to compete with other agencies seeking funds from Congress to carry out their responsibilities.

When a disease emerges in a new location, such as African Swine Fever (ASF) in Brazil and the Dominican Republic, there is an immediate need for information—particularly for our swine industry. What is this disease all about? What is known about it? What can be done about it? Naturally the big source of information is our data bank.

This is just one disease, but there are many others throughout the world. The people who are aware of their existence are anxious to get information on these diseases. That is why they come to us. This is extremely important. To justify the need for this information, I must deal with "in-house" Department of Agriculture economists, with Office of Management and Budget personnel, and with Congress. All of these people evaluate our programs, particularly from a cost/benefit standpoint, to decide whether the information justifies the costs involved in obtaining it.

Cooperation of Data Banks in Animal Disease Reporting. Looking ahead to the 1980's, I foresee a need to pool our resources in developing national and international animal disease data banks that we can all use. When I last saw Peter Ellis, we discussed the need to get most of our people heavily involved in epidemiology. This would help them determine the facts on these diseases in the field and avoid jumping to conclusions. It seems to me that we are in the same situation now. We need to have an epidemiological type of approach—to develop the necessary data banks and provide a sound basis for carrying out our programs.

In this country, it is unbelievable that we don't have a sophisticated animal morbidity/mortality reporting system. We don't know exactly how diseases affect our animal populations. We often jump to conclusions based only on experiences we have had with some herds. Are you aware that getting the money to establish a morbidity/mortality system is almost impossible? It is expensive, and those same people who challenge us for not having the data are unwilling to contribute the money toward getting the information we are seeking. We know, however, that someday we will have a National Animal Morbidity and Mortality Report. Meetings such as this increase the interest in animal disease reporting. Your participation in this seminar indicates that you consider it worthwhile.

Livestock Identification Needed in Epidemiology. Also in the 1980's we expect to have a national livestock identification system—something we

don't have right now. It seems ironic that most companies selling a product will identify it, but people who are selling livestock do not identify their product.

Solutions to this problem are coming. APHIS has invested money to develop an electronic identification system for livestock. Eventually we should have some type of system that will tell us where each animal is located and where it has been at each stage of production. When livestock move, identifying information will enter a computer and we will be able to determine where the animal originated, what markets it passed through, and where it went for slaughtering. We will be able to trace the animal's history from slaughter back to its origin. In the 1980's you will see it happen, and that is going to give our data more validity.

Information on Research. I recall a similar problem with research data when I was one of the Associate Administrators for Agricultural Research Service. Often, when we asked Congress for research money, they asked, "How do you know that that research hasn't already been done by somebody else somewhere in the world?" We were rather vulnerable. It would have been difficult to say that we knew that nobody else was doing that. So the Current Research Information System (CRIS) was developed to help identify research and allow us to tell Congress that we knew a research program was not a duplication.

I have recently been appointed to the Animal Health and Disease Research Advisory Board to allocate money for research on animal diseases, emphasizing research in veterinary schools. We spent a lot of time in our last two meetings developing priorities for diseases on the basis of their economic and public health effects in our country. The task is not yet completed.

The Board is obtaining data from industry people. To some extent, the validity of their data may be challenged. Nevertheless, they have a system for determining, from their standpoint, which diseases they think are most significant. Veterinary schools and government regulatory agencies also are represented on the Board. Ultimately the Board will identify areas of animal disease research that merit an appropriated amount of $15 million. We expect this activity to continue annually.

A discussion of animal disease data banks is important. Congress recognizes that we have been deficient in our research commitments to animal diseases. Discussions here indicate a strong current interest in animal disease data banks.

Sharing of Data. So then, why this symposium? I believe that it has served the purpose of showing that what we need can't be provided by any one group. It can't be done by one state...one country...or one region of the world. What we are really looking for are ways to pull together all

the data on a worldwide basis so that we can derive mutual benefits from it. Information handling is very costly, and pooling information makes for greater economy. We share an interest in determining which data offer the most mutual benefit. Sharing information is an idea that is not always easy to accept. It is so basic, however, that sharing is inevitable.

I believe that we need to publicize what we are doing here to enlighten others about this potential. I am encouraged by the symposium attendance because I think that a variety of needs must be met: those of librarians, researchers, industry people, economists, epidemiologists, the extension service, and others. The encouraging part of it is that we can pool our information and learn what we need to do together. We can do our own jobs and still make our animal disease data banks effective and beneficial to us all.

Continual Exchange of Information Is Needed. I conclude that we need to have a continual exchange of many different kinds of information. We need to improve the quantity and quality of the data available throughout the world. We need to pool our efforts to help design future systems that are complete and cohesive, and not as dissipated and uncoordinated as in the past.

We need international, national, and individual leadership to conceptualize the whole problem. We then must design some process by which we approach the future so that we can make the most progress in the shortest time. I think we are at a stage of cultivating, not just of sowing seeds. We have identified data sources, and we recognize that these sources are scattered. We need a common language to get more efficient use of data. We must adopt compatible systems of animal identification, statistically valid sampling and numerical groupings, and standardizations to facilitate exchange and comparison of data.

All of this represents my impression of the importance of this symposium. I want to thank all of you for participating. In the Animal and Plant Health Inspection Service we find it beneficial. I hope you find it equally beneficial to you and your organization.

APPENDIX

International Symposium on Animal Health and Disease Data Banks
December 4-6, 1978

SYMPOSIUM COMMITTEES

General Chairperson	Edwin I. Pilchard	Principal Staff Officer for Scientific Resources, Emergency Programs, Veterinary Services, Animal and Plant Health Inspection Service, U.S. Department of Agriculture
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	John Birdsall, Adviser	Scientific Director, American Meat Institute
	Nelson B. King, Adviser	Associate Dean, School of Veterinary Medicine, Auburn University

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Laboratory and Clinical Data	Howard M. Hayes, Jr.	Environmental Epidemiology Branch, National Cancer Institute
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